EVALUATION OF PETITION: REQUEST OF THE CENTER FOR BIOLOGICAL DIVERSITY ET AL. (2004) TO LIST CALIFORNIA TIGER SALAMANDER (*Ambystoma californiense*) AS ENDANGERED

EXECUTIVE SUMMARY

On February 13, 2004, the Department of Fish and Game (Department) received a petition to list the California tiger salamander (*Amybstoma californiense*) as an Endangered species under the California Endangered Species Act (see generally Fish & Game Code, §2073.5, subd. (a); California Code of Regulations, Title 14, §670.1, subd. (d)(1).). The petition was submitted to the Fish and Game Commission by the Center for Biological Diversity, Environmental Defense Center, Defenders of Wildlife, Sierra Club Sonoma Group, Citizens for a Sustainable Cotati, VernalPools.org, Citizens' Committee to Complete the Refuge, Butte Environmental Center, and Ohlone Audubon Society.

Conclusions

As required in §§2072.3 and 2073.5 of the Fish and Game Code, the Department has evaluated the sufficiency of information presented in the petition and supporting data. We believe the petition, in combination with additional available information and analysis, includes sufficient scientific information to indicate that the petitioned action may be warranted due to a variety of conservation problems and threats. We recommend that the Fish and Game Commission accept and consider the petition.

The Department believes the petitioned action may be warranted due primarily to the following threats:

1) Continued loss and fragmentation of natural aquatic breeding and non-breeding terrestrial habitat due to urbanization

2) Presence of pure and hybrid populations of non-native eastern tiger salamanders (*Ambystoma tigrinum* ssp.) which interbreed with native CTS

3) Predation and competition from non-native predatory species in artificial breeding habitats

4) Limited protection of populations via existing public lands, reserves or planning areas

5) Ineffectiveness of existing regulatory mechanisms to adequately protect breeding and non-breeding habitats

6) Serious risk of becoming endangered throughout its entire range due to the combination of threats identified in 1-5, above

Life History, Distribution, Population Trend, and Management Status

The CTS occurs only in California. The species spends most of its life in underground retreats. Although the species is long-lived, it may breed only once during its lifetime. In any given year, a variable number of adult CTS migrate to temporary pools and permanent ponds to breed. The survival rate of larvae to mature adults is highly variable, but generally small. Since no long-term monitoring data are available range-wide, these aspects of CTS life history make estimation of total CTS population numbers range-wide inaccurate and biologically inappropriate.

Change in distribution must be inferred from historic and projected loss of breeding (aquatic) and estivation (terrestrial) habitat. Seventy five percent of historical vernal pool habitat in the Central Valley has been lost and fragmented, as has much of its terrestrial refugium habitat. Existing regulatory mechanisms are inadequate to protect remaining habitat, and projected additional habitat loss will likely affect significant portions of CTS range.

The CTS is currently a Department Species of Special Concern, which is an administrative designation intended to alert biologists, land managers, and others to the species' declining status and to encourage them to afford it additional management consideration. Populations of CTS in the counties of Santa Barbara and Sonoma were first listed by the U. S. Fish and Wildlife Service (USFWS) as Endangered under the Federal Endangered Species Act. In late July 2004, populations in the rest of the CTS's range (i.e., Central Valley populations) were listed as Threatened, and those in Sonoma and Santa Barbara counties were reclassified to Threatened.

INFORMATION PROVIDED IN THE PETITION AND ADDITIONAL INFORMATION GATHERED BY THE DEPARTMENT

Range and Distribution ("Distribution" in Petition)

The California tiger salamander (CTS) is found only in California. The petition states that CTS optimal habitat is low elevation vernal pools surrounded by upland habitat containing rodent burrows or other suitable dry-season refugia. This is a generally accurate description of CTS habitat. This species occurred historically in and near long-lasting rain pools in the Central Valley and low elevation foothills of the Sierra Nevada and Coast ranges from Colusa County south to Santa Barbara and Tulare counties (Jennings and Hayes 1994, Shaffer et al. 1993). According to Shaffer et al. (1993), CTS "were probably never abundant in the San Joaquin saltbush community of the southern San Joaquin Valley, and are absent today from this habitat in the Carrizo Plain in San Luis Obispo County. They were also probably found only intermittently in the Tule Marsh floodplain surrounding the major rivers, since these marshes were probably home to fishes, at least during wet years. However, there is every reason to expect that they were continuously distributed in the California Prairie, Valley Oak savannah, and the lower reaches of the Blue Oak-Digger Pine communities up to about 1500 ft elevation". Currently, CTS primarily inhabit grasslands of the Central Valley and oak savannah plant communities of the Sierra Nevada and Coast Range, generally below approximately 1,500 ft (Stebbins 1985, Barry and Shaffer 1994, Jennings and Hayes 1994). Of 857 extant CTS records in the Department's California Natural Diversity Data Base (CNDDB) and other data sources (see Appendix 1), roughly 100 occur at elevations above 1,500 ft. In the Bay Area, CTS has been reported at an elevation of approximately 3,600 ft (Bobzien 2003). Habitat requirements are discussed in more detail under "Kind of Habitat Necessary for Survival", later in this evaluation.

The petitioners provided a range map for CTS in the petition. A CTS range map (from Uram et al. 2003) was also provided to the Department for use during our petition evaluation. When assessing this information, it appeared that the petitioners overestimated CTS range and Uram et al. (2003) underestimated CTS range. Therefore, using GIS analysis, we generated our own CTS range and distribution map using a combination of CNDDB and other occurrence data, elevation, and Jepson Ecological Zones (Figure 1). Figure 2 compares the boundaries of the petitioners' map, the Uram et al. (2003) map, and the Department's map.

In a 1994 analysis, Jennings and Hayes depicted the distribution of the species (Figure 3) at sites that represent most of its historical range, as shown in the petition map. Although the species still occurs within many areas of its historic range, natural CTS breeding (wetland) and estivation (non-breeding=mostly grassland) habitat within the historical range has been significantly reduced and fragmented (Holland 1998, Shaffer et al. 1993, USFWS 2003a).

Figure 1

Figure 2

Figure 3

Holland (1998) examined vernal pool complexes - the most important CTS breeding habitat type according to Shaffer et al. (1993) - throughout California. Holland estimated a loss of historical vernal pool landscapes of approximately 75% statewide. Figures 4 and 5 illustrate the dramatic changes in Central Valley habitat pre-1900 compared to the 1995 landscape. Shaffer et al. (1993) estimated that at least 75% of the salamander's historical terrestrial habitat in the Central Valley has been lost.

The only range-wide scientific field survey of CTS distribution was a Department contract study done by Shaffer et al. (1993). The goals of their study, as summarized in the report abstract, were "1) to document the present distribution of the CTS, including both historical localities and new ones, 2) to survey for ecological factors that may be responsible for habitat deterioration, 3) to conduct genetic surveys of all populations to determine the amount of genetic differentiation and levels of migration among populations, and 4) make recommendations on the status of the species, its short and long-term survival prospects, and the critical parts of the habitat that must be protected if the species if to remain viable in the future". This study was subsequently incorporated into a published, overall assessment of the decline of pond breeding amphibians throughout the Great Central Valley and Coast Range (Fisher and Shaffer 1996). Both studies focused on detecting larval CTS in either known (historical) locations or what the researchers thought to be appropriate habitat. Due to the size of CTS range, Shaffer et al. were only able to sample representative ponds, concentrating their sampling in what appeared to be the best habitat. Their work, therefore, represented a minimum number of reproducing populations of CTS. Their surveys did not definitively determine presence or absence in an area, but gave a reasonable indication of patterns of breeding activity in prime habitat in a given region. No standard CTS survey protocol was available in 1993. The first standardized CTS occurrence survey protocol was developed in 1997 by the Department with input from four consulting biologists, for use primarily for CEQA pre-project surveys (Brode 1997). A joint Department/USFWS survey guidance was developed in October 2003 (USFWS and CDFG 2003).

During 1990-1992, Shaffer et al. (1993) surveyed 324 ponds throughout the Central Valley from near Redding to the Tehachapi Mountains, and in the Coast Ranges and associated valleys from Santa Barbara County north to Santa Rosa. They verified the presence of CTS at 36 (42%) of 86 historic localities (some consisting of multiple ponds). Of the 121 ponds surveyed within the historical localities, CTS presence was verified in 53 (44%) of them.

The Shaffer et al. (1993) surveys included 176 potential CTS localities that appeared to meet the salamander's habitat requirements and where its presence had not been previously documented. CTS occupancy was confirmed at only 15 (8.5%) of these localities. Figure 6 illustrates currently known CTS localities and areas where Shaffer et al. 1993 surveyed but did not find CTS (i.e., negative locality data). Although the negative locality data do not definitively indicate absence of CTS, surveys were conducted in

Figure 4

Figure 5

Figure 6

perceived optimal habitats, and demonstrate that CTS experts attempted to find the species in a variety of previously undocumented locations. Numerous other CTS surveys from a variety of sources (e.g., biological consulting firms) undoubtedly produce negative data as well, but this information is not readily available since CNDDB tracks only positive locality data, and there is no other central repository for CTS survey results.

Shaffer et al. (1993) stated that CTS populations largely remain only in the higher elevation areas at the margin of their ecological requirements, because much of the low-elevation valley habitat has been eliminated. Fisher and Shaffer (1996) found that for three species of Central Valley pond breeding amphibians, including CTS, historical localities were significantly lower in elevation than current populations.

The petition discusses CTS distribution in detail in the context of three main "distributions" (i.e., populations): Sonoma County, Santa Barbara County, and Central California, with four subdistributions of the Central California area. Genetic work by Shaffer and Trenham (2002) analyzed the most recently available and comprehensive mitochondrial DNA (mtDNA) dataset available for CTS. Independent peer-reviews provided to the USFWS by geneticists (K. Crandall 2003, R. Murphy 2003, D. Wake 2003), support Shaffer and Trenham's recognition of six genetically distinct populations. Shaffer and Trenham's work, although peer-reviewed, was not published at the time of the USFWS' proposed rule to list CTS range wide or when the state listing petition was being prepared. The results of their ongoing CTS genetic work are currently being published (Shaffer et al. In Press), however, and support their 2002 conclusion that six geographically discrete genetic units of CTS exist.

The USFWS (2003) used Shaffer and Trenham's 2002 work to treat Santa Barbara and Sonoma County CTS as two Distinct Population Segments (DPSs) (a formal designation under the Federal Endangered Species Act), and proposed the four populations in the Central Valley as a single Central Valley DPS, which is genetically distinct from the Sonoma County and Santa Barbara County groups. The USFWS treated the four Central Valley populations as one DPS because, at that time, the geographic boundaries between some of them had not been fully delineated (e.g., Bay Area and Central Coast Range populations in the vicinity of the Contra Cost County/Alameda County lines, and the border between the Central Coast Range/Central Valley populations). The USFWS recognized, however, that Shaffer and Trenham's (2002) work suggested that levels of interchange among these populations are low, and therefore discussed threats to each of the four Central California populations individually in their 2003 analysis. Shaffer et al. (In Press) supports this approach, and we will therefore use it to discuss threats to each of the Central California populations, as well as the Sonoma County and Santa Barbara County populations, individually. Figure 7 illustrates the geographic locations of the six CTS populations.

The petition presented extant CTS locality information based on 2002 CNDDB data. We updated this information in Table 1, below.

Figure 7

Table 1. Number and percent of presumed extant CTS occurrences in CNDDB as of May 2004.

Population Geographical Area	**CNDDB extant localities**	**% presumed extant localities rangewide**
Bay Area	225	32%
Central Coast	84	12%
Central Valley	278	39%
Santa Barbara	20	3%
Sonoma	51	7%
Southern San Joaquin	50	7%
TOTAL	708	100%

It is important to note that localities in CNDDB are maintained as extant or presumed extant until documentation has been provided that a locality has been extirpated. Therefore, an unknown number of localities in CNDDB may, in fact, be extirpated.

Uram et al. (2004) provided information directly to the Department for use during this petition evaluation. They used CNDDB data in an analysis of CTS localities, presented them as "abundance records", and stated that "[a] CTS locality is a site where at least one CTS has been identified as being present and which ponds sufficiently to support breeding." This use of CNDDB locality data is inappropriate. CNDDB localities can consist of any life-stage, either alive or dead CTS (including road-kills), and do not necessarily represent breeding sites (see Appendix 1, CNDDB data notes). The CNDDB data notes section of Appendix 1 also explains additional incorrect use and interpretation of CNDDB locality data by Uram et al.(2003, 2004), i.e. an unsupported population estimate using CNDDB data, the rationale that increasing CNDDB CTS locality data in recent years should be interpreted to mean that "the more one looks for the CTS, the more one finds extant localities" (Uram et al. 2004), the decision to remove 23 CNDDB CTS locality records from their CTS range analysis, and the claim that they had 74 CTS locality records which were not in CNDDB.

<u>Life History</u> (Species Description, Biology, and Ecology; "Description, Biology, and Ecology of the CTS" in the Petition)

Overall, the petition provides an adequate description of CTS life history traits. Availability of long-term studies specifically on CTS is limited in the literature, and as a result, many of the references on CTS life history in the petition are based on a small number of studies, or even a single study or anecdotal observation.

CTS are members of the family Ambystomatidae, or the mole salamander family. They are large (3-6½ inches excluding the tail) (Stebbins 1985) and stocky with black skin with numerous yellow to white spots (Figure 8).

Formerly thought to be a subspecies of the eastern tiger salamander *Ambystoma tigrinum*, CTS is now recognized as a distinct species based on genetic analyses by Irschick and Shaffer (1997) and Shaffer and McKnight (1996). Shaffer et al. (1993) concluded at least seven genetically distinct units of CTS exist. Further analysis (Shaffer and Trenham 2002) supports the interpretation that recognition of the six genetically distinct units of CTS, discussed above under "Range and Distribution", is appropriate.

Seasonal activity and reproductive behavior of the CTS are covered in detail in the petition under "Reproduction and Growth" and "Movement". In summary, adult seasonal migration activity (i.e., movement from upland areas to breeding ponds) and reproductive behavior of CTS are associated. Until the fall rains begin, adult California tiger salamanders reside underground in small mammal burrows. The start of the fall rains, usually between October and November, initiates the onset of nocturnal CTS migrations (typically movement of less than 0.5 mi) to temporary or permanent pools to breed. CTS will generally not move to ponds to breed if weather conditions are unfavorable (e.g., drought, atypical timing of rainfall) (Trenham et al. 2000). Most adults breed and return to the upland habitat within one to two weeks, but some may remain at the breeding pools for several weeks. When the pools begin to dry, metamorphosed juveniles will migrate to the upland habitat to estivate.

The petition did not mention an apparently atypical juvenile movement phenomenon. Holland et al. (1990) documented a late summer migration of juvenile CTS to a seasonal lake. The migration was stimulated by a significant rainfall during a season that is normally dry. Nearly all salamanders in this unusual migration during hot weather died of dehydration. The authors concluded that juvenile CTS can exhibit unseasonable migration and cautioned against stereotyping CTS movements.

The following information on CTS movement is also in addition to that included in the petition. Tracking studies of CTS (Trenham 2001), and six other species of Ambystomatid salamanders summarized by Semlitsch (1998), suggested that 95% of adult movement occurs within 820 ft (250 m) of the breeding pond. The most recently available information about CTS movement, however, indicates that 95% of adults disperse to within approximately 1,500 ft (450 m) and 95% of subadults to within approximately 2,100 ft (640 m) of the breeding pond (Trenham and Shaffer In Revision). Trenham and Shaffer (In Revision) used results of trapping arrays to avoid the assumptions that radio transmitters do not affect animals and that salamander migration distances follow a normal distribution (Semlitsch 1998, Trenham 2001). They fit statistical models to the spatial distribution of capture rates to obtain the 95% estimates above.

Figure 8

After analysis of seven years of data (1992-1998) at a single breeding pond in Monterey County, Trenham et al. (2000) estimated that fewer than 50% of individual breeding salamanders returned to breed a second time. Adults are four to five years old when they breed for the first time, although some salamanders were sexually mature by 2-3 years of age. Trenham et al. (2000) estimated an individual CTS can live for 10 or more years, but adults do not breed every year (Trenham et al. 2001). Trenham et al. (2000) estimated that the average female salamander at their study pond in Monterey County bred 1.4 times and produced a lifetime total of approximately 12 offspring that survived to metamorphosis. To maintain the population of this pond, survival from metamorphosis to breeding would have to be over 18%. However, the researchers' highest survival estimate was less than 5% survival from metamorphosis to breeding, so mean reproduction was below replacement in all six years of the study. They estimated that this population was doomed to local extinction, but also cautioned that conclusions about population stability based on one pond are premature. Their calculated demographic parameters are consistent with those of eastern species of *Amybstoma*, however (e.g., Shoop 1974, Stenhouse 1987, Loredo and VanVuren 1996).

The petition, citing Trenham et al. (2000), stated that about 10 weeks are required for complete metamorphosis from egg to juvenile, and that CTS reach sexual maturity at about six years of age. The metamorphosis time period is correct; however, as stated above, four to five years (average) are necessary for CTS to reach sexual maturity.

Larval CTS consume aquatic invertebrates, snails and tadpoles. Juvenile and adult CTS feed on aquatic and terrestrial invertebrates (Anderson 1968).

<u>Kind of Habitat Necessary for Survival</u> ("Habitat Requirements" in Petition)

The petition does an adequate job of discussing habitat, however, the Department has added to the following discussion additional relevant information which recently became available or was not included in the petition. For non-breeding habitat, California tiger salamanders require low-elevation grasslands of the Central Valley and oak woodlands of the Sierra Nevada and Coast Ranges (Jennings and Hayes 1994). To avoid dessication, CTS spend most of their life in the occupied or recently deserted burrows of small mammals. Adult CTS primarily use the burrows of California ground squirrels (*Spermophilus beechyi*) and Valley pocket gophers (*Thomomys bottae*) as their underground retreats (Barry and Shaffer 1994, Trenham 2001). Vole (*Microtus californicus*) burrows have also been documented as subterranean refugia for CTS (Cook and Northen 2004). Newly metamorphosed CTS, however, were observed settling into ground squirrel and soil cracks in roughly equal proportions (Loredo et al. 1996). Juveniles have also been observed to use sandbags in a retaining wall as a retreat (Barry and Shaffer 1994). Earthen mounds created to encourage small mammal activity in CTS preserve habitat in Sonoma County were rapidly colonized by gophers and voles, but were used primarily by metamorphs emerging from the breeding pond rather than adult CTS (Cook and Northen 2004).

Given the low annual reproductive success of ambystomatid salamanders, regulation of CTS population numbers may be more dependent on terrestrial survival than previously thought (Trenham et al. 2000). Since subadult CTS disperse further from breeding ponds than adults (Trenham and Shaffer In Revision), and survivorship through the subadult phase is essential for continued population viability (Biek et al. 2002, Trenham and Shaffer In Revision), the distribution of subadults in the terrestrial landscape is an important component of CTS conservation planning.

CTS travel from upland habitats to breed in ephemeral ponds (i.e., vernal pools) (Figure 9) and in permanent ponds that lack fishes and nonnative bullfrogs (*Rana catesbeiana*) (Barry and Shaffer 1994, Shaffer et al. 1993, Stebbins 1985, Storer 1925) (Figure 10). Both natural and artificial ponds (e.g., stock ponds) are used. However, since many permanent ponds in historical CTS habitat contain introduced fishes and bullfrogs, CTS are generally restricted to large, long-lasting ephemeral ponds such as large vernal pools (Shaffer et al. 1993). Vernal pools are the most important breeding habitat for the CTS (Shaffer et al. 1993).

For amphibians, local population dynamics and connectivity of populations are the foundation of species conservation (Semlitsch 2002). Maintenance of connected local populations is critical because pond-breeding amphibian populations vary widely in size, have episodic recruitment, are subject to local extinction, and depend on recolonization. Local population processes affect the number and density of individuals produced at or dispersing from individual wetlands (Semlitsch 2002). Inter-pond dispersal (i.e., connectivity) of CTS is impeded where barriers like roads and urban development occur (Marsh and Trenham 2001).

Population model simulations by Trenham and Shaffer (In Revision) suggest that in the absence of catastrophes, even fairly small breeding ponds may sustain viable populations of CTS. The size of the population sustained is related to the size of the pond, however. They predicted that a small (0.035 ha) pond with completely intact upland habitat would support an adult population of fewer than 10 females on average, whereas a larger (0.14 ha) pond would support an average population of approximately 46 adult females. In a situation where only a 100 ft (30.8 m) wide buffer of intact upland habitat was left around a breeding pond, however, the model predicted a pond would have to be larger than 3,000 ha for persistence of the population beyond 100 years. In addition to pond size and amount of upland habitat, stochastic factors (e.g., drought) also play a role in the long-term success of pond breeding amphibian populations. For example, Semlitsch et al. (1996) found that a small, isolated wetland (1 ha) in South Carolina protected for over 30 years had annual reproductive failure rates of 42-56% (due to factors such as low rainfall) for 13 species over a 16 year period. Any non-random threat that adds to metamorphic failure (e.g., pond discing, fish introductions) or disrupts dispersal (e.g., upland habitat loss, roads) increases the probability of local declines and extinctions (Semlitsch et al. 1996).

Figure 9

Figure 10

Population Trends, Abundance ("Abundance and Population Decline" in Petition)

Available studies relating specifically to CTS population dynamics are primarily presence/absence surveys. Limited scientific data are available on abundance of individual populations of CTS, and there is no comprehensive, range-wide population estimate. There is no standard protocol for determining CTS population size. The difficulty of estimating total CTS population size has been documented by several researchers (Jennings and Hayes 1994, Shaffer et al. 1993), though estimates have been made for a few individual populations (Trenham et al. 2000, Loredo et al. 1996, Barry and Shaffer 1994). These studies represent only a snapshot-in-time for single populations or ponds, however. Results, observations, and conclusions obtained at one site may not apply to other sites and cannot be used to represent or predict long-term population trends. Counts of adults appearing at breeding ponds each year do not necessarily reflect true variation in actual adult population size of long-lived ambystomatid salamanders. These animals may skip breeding in unfavorable years or switch breeding sites regularly, thus the numbers of reproductively active adults may vary substantially from one year to the next, yet absolute adult population sizes likely vary less so (Bishop et al. 2003). These factors lead the Department to the conclusion that, absent long-term monitoring data produced by a scientifically designed study, attempting to estimate the total population size of CTS range-wide is not appropriate with available information.

Uram et al. (2004), however, provided a population estimate of 500,000 - 800,000 CTS, based on an unsubstantiated assumed average of 1,000 individuals per CTS locality. Although their methodology is not explained nor supported by any literature citations, they appear to have multiplied each CNDDB locality by 1,000 to arrive at 754,000 CTS (754 x 1,000). However, one published study found that the three year mean number of CTS varied from three individuals at one pond to 327 individuals at another (Trenham et al. 2001). The mean for all 10 ponds over the three year period was 63.5 CTS per pond. If the Uram et al. (2004) methodology is employed using this published information, 754 localities multiplied by 63.5 results in a statewide population estimate of 47,879 individuals, a number that differs by an order of magnitude from that of Uram et al. (2004). The Department provides this calculation solely to illustrate that available literature indicates the estimate of Uram et al. (2004) may significantly overstate actual CTS numbers. As explained above, the Department does not believe the number of CTS can be accurately estimated, or, for that matter, that such estimates are essential to a determination that CTS may be in serious danger of extinction.

Information about past distribution of CTS can be gleaned from historical data (e.g., museum records), however, to assess patterns of change leading to present-day distribution (e.g., Shaffer et al. 1993). To reduce potential error when estimating decline and distributional change using resurveys based on limited past information, the level of detail of analysis can be traded off for robustness of conclusions by focusing on coarser levels of distribution within geographic units for which a number of historical records are known (Skelly et al. 2003). The county-by-county analysis used by Fisher and Shaffer

1996 is an example of this trade-off, and was used to reduce their error when estimating the range-wide decline of CTS.

The petition states that there is clear evidence of significant population declines, based on documented habitat loss. Jennings and Hayes (1994), as part of a statewide status assessment of amphibians and reptiles, examined historical and current CTS locality records to help determine the extent of CTS population losses. As of 1994, based on both verified museum records and verified sighting data, numerous populations of CTS had been extirpated (i.e., no longer existed in a specific location) (see Figure 3, above). Jennings and Hayes (1994) indicated that the CTS appeared to meet the California Endangered Species Act definition of "Threatened". This conclusion was based on the species' declining population trend and attributed to unique habitat requirements, habitat loss and fragmentation, effects of introduced non-native species, artificial migration barriers (e.g., roads), and the 1986-1990 drought.

Given the lack of both historical and current data about CTS abundance range-wide, the fact that the species spends most of its life underground, and the fact that only a fraction of individuals migrates to breed every year, existing trend studies (i.e., Shaffer et al. 1993, Jennings and Hayes 1994, Fisher and Shaffer 1996, and Davidson et al. 2002) must be used to assess the species' status. The petition cites and briefly discusses all of these trend studies except Fisher and Shaffer (1996).

We used all of these trend studies and our own GIS analysis of the remaining available CTS habitat to determine that CTS populations and habitat have declined. We analyzed remaining potential CTS habitat using a geographic information system (GIS) (Table 2). (See Appendix 1 for GIS methodology used in our evaluation report.)

Table 2. Estimate of remaining potentially suitable habitat within the range of the CTS. (Data sources include CTS Sonoma range: USFWS 5/2004, Urban: U.S. Bureau of the Census 2000, General Plan: State of California Legacy Project, low, medium, and high density commercial and residential and industrial, Dept. Water Resources Land Use Survey and Central Valley Wetlands and Riparian Data: orchards and vineyards.)

Population Geographical Areas	**Population Acreage**	**Potentially Suitable Habitat**	**Percent Region with Potentially Suitable Habitat**
Bay Area	2,656,132	1,231,423	46%
Central Coast	3,969,390	1,803,645	45%
Central Valley	5,693,728	1,591,004	28%
Santa Barbara	186,862	99,617	53%
Sonoma	58,336	7,338	13%
Southern San Joaquin	1,737,385	318,736	18%
TOTAL AREA	14,301,832	5,051,763	35%

Total acreage of potential habitat by CTS population varies from a little over 7,000; (2,833 ha) to about 1.8 million acres (728,437 ha; 7,284 km^2). We calculated that approximately 35% of the acreage contained within what we defined as CTS total geographic range is potentially suitable habitat. This is a gross level analysis – the acreage of actual occupied CTS habitat will be much smaller number since essential CTS habitat components are not present throughout the entire potential habitat. Extensive habitat fragmentation has occurred in much of CTS range due to existing agricultural land use and urban growth and roads (see additional discussion on habitat fragmentation under "Factors Affecting Ability to Survive and Reproduce", below). Therefore, the amount of occupiable habitat is significantly less than that calculated in our analysis of potentially suitable habitat.

Figure 11 illustrates the known distribution of CTS as of May 2004 in relation to what we determined to be remaining potentially suitable habitat.

The USFWS also determined that CTS populations and habitat have declined. On September 21, 2000, the USFWS listed the Santa Barbara County CTS DPS as Endangered (USFWS 2000a), and on March 19, 2003, listed the Sonoma County DPS as Endangered (USFWS 2003a). In 1994, the USFWS, in response to a 1992 petition to list the species (range wide) as Endangered, determined that listing was warranted but precluded by other, higher priority actions (USFWS 1994). On May 23, 2003, the USFWS published a Proposed Rule to list the Central California CTS DPS (which contains the remaining, four genetically distinct populations) as Threatened (USFWS 2003b). In July 2004, the USFWS listed the CTS as a threatened species throughout its range.

<u>Factors Affecting Ability to Survive and Reproduce</u> (categories 1-6 below are discussed as separate sections under "Nature and Degree of Threat" in petition)

The Department found evidence that, as the petition states, the primary threat to CTS currently and in the foreseeable future is destruction and modification of habitat due to a variety of causes (Jennings and Hayes 1994, Shaffer et al. 1993, Fisher and Shaffer 1996). Less obvious is the habitat that has or will become unsuitable for CTS due competition from and predation by introduced and established exotic vertebrate species, including the non-native bullfrog and non-native fishes (Jennings and Hayes 1994). Another serious threat to CTS is hybridization with the non-native "waterdog", an eastern tiger salamander (*Ambystoma tigrinum* ssp.) formerly imported into California as live fish bait and now established as wild populations in various locations. Threats may also include diseases, contaminants, agricultural practices, and other factors. Below is a summary of the petition information for these threats, with additional information provided by the Department.

Habitat Destruction and Fragmentation: Population growth is a threat because CTS habitat destruction and fragmentation results from housing, business, agriculture

Figure 11

and associated infrastructure (e.g., roads, airports, flood control structures and associated habitat modification or loss) that accommodates population growth. The petition discusses current and projected human population growth within the range of CTS. The petitioners used Association of Bay Area Government documents (1999) which forecast a 16% overall increase in the human population of the nine county Bay Area over the 2000 to 2020 time period. The petition documents population growth forecasts significantly higher than 16% for the remainder of counties within the range of the CTS. Population estimates from the California Department of Finance (http://www.dof.ca.gov/HTML/DEMOGRAP/repndat.htm) provide current and projected population growth data to 2050 by county. The data presented in the petition, however, do not indicate where this growth will occur within each county relative to known CTS occurrences or habitat. Figure 12 illustrates, within the range of each population, where the footprint of projected growth will occur (based on County General Plans) relative to CTS occurrence and remaining habitat. The Department concurs that human population growth plays a role in the continued elimination of CTS habitat. The effects from growth will be significant primarily in the western portion of the Bay Area and Central Valley populations, northern portion of the Central Valley population, and northeastern portion of the Southern San Joaquin population.

The petition presents information on general destruction of native prairie and vernal pool habitat throughout California. Figures 4 and 5 illustrate the changes in the Central Valley landscape pre-1900 compared to 1995. The petition included detailed information extracted from various sources on losses of vernal pool habitats within the range of the CTS (Keeler-Wolf et al. 1998, Holland 1998, USFWS 2002). Holland (1998) concluded that 80% (4 million acres; 16,187 km^2) of vernal pool habitat had been lost, and that at the current rate of loss, the remaining amount would shrink to 12% (480,000 acres; 1,943 km^2) of the historical total by 2044. Using GIS to clip our CTS range to Department of Conservation Farmland Mapping and Monitoring Program website data (see Appendix 1), we determined that during 1990-2000, a net loss of 69,812 acres of grazing land occurred within the range of the CTS.

Habitat conversion associated with continued urbanization and change in land use to more intensive agriculture has been source of significant habitat loss to CTS (USFWS 2003a). In some areas, these factors will continue to result in loss and fragmentation of CTS habitat. For example, Figure 13 shows the relationship of known CTS locations in the Central Valley and Southern San Joaquin populations to existing urban areas, the location of future growth, and the location of intensive agriculture. This figure illustrates the fragmentation that has, and will continue to occur, in CTS habitat.

Habitat fragmentation has been shown to negatively affect long term viability of animal populations. Habitat fragmentation can be defined as dissection of habitat into smaller portions that do not allow free movement of individuals (Westerman et al. 2003). Habitat fragmentation has two components, both of which cause extinctions: (1) reduction in total habitat area, and (2) redistribution of the remaining area into disjunct

Figure 12

Figure 13

fragments (Wilcove et al. 1986). Isolation of habitats reduces or eliminates the ability of a single population to recover from a catastrophic extinction event by recolonization from a nearby population (Semlitsch and Brodie 1998, Bishop et al. 2003). Due to the dynamic nature of amphibian populations, dispersal is an important factor in maintaining viable populations across large areas. Pond isolation is significant aspect of population persistence within landscapes fragmented by human-created barriers to dispersal such as roads, railroads, and croplands (Bishop et al. 2003). Trenham et al. (2000) found that less than 50% of individual CTS return to breed a second time, so recolonization potential, even in intact pond assemblages, may be less than that of other amphibians with high reproductive output, such as the Pacific chorus frog (*Hyla regilla*). Green (2003) concluded that species with highly fluctuating populations and high frequencies of local extinctions, such as pond breeding amphibians, are likely to be affected rapidly and catastrophically by habitat fragmentation.

Habitat fragmentation can also impact gene flow among remaining interbreeding populations, putting the genetic vigor and therefore viability of the entire species ultimately at risk. For example, Reh and Seitz (1990) reported genetic changes in the common frog (*Rana temporaria*) resulting from roads or other linear barriers isolating previously connected populations. Reh and Seitz were able to detect reproductive isolation biochemically, even though they estimated only 10-12 generations had occurred since the barriers were installed. For CTS, increased habitat fragmentation and isolation means that there is decreasing opportunity for genetic mixing between populations and recolonization after a local extinction event.

The petition states (under the “Abundance” section) that CTS habitat is increasingly fragmented, which isolates CTS populations and renders them more vulnerable to loss of individual populations. The Department finds evidence of significant loss and fragmentation of known CTS habitat.

Roads: Roads present serious barriers to migration and thus contribute to habitat fragmentation. The USFWS (2003) stated that relatively high road use and road density values result in road kill mortality being a potentially serious threat CTS, a threat that will likely continue to grow in concert with California’s rapid population growth. Roads are a significant source of direct mortality to amphibians, including salamanders, traveling to and from breeding areas. The Federal Highway Administration has a website (http://www.fhwa.dot.gov/environment/wildlifecrossings/main.htm) called “Critter Crossings” dedicated to linking habitats and reducing road kill. Jackson (1996) stated that roads separating breeding and upland habitat can be the cause of significant population declines and even local extinctions for the spotted salamander (*Ambystoma maculatum*).

Roads are a source of direct CTS mortality. Significant numbers of CTS are killed by vehicular traffic while crossing roads (Hansen and Tremper 1993; S. Sweet, in litt. 1993; Joe Medeiros, Sierra College, pers. comm. 1993; all cited in USFWS 2003a).

During one 15 day period in 2001 at a Sonoma County location, 26 road-killed CTS were found (D. Cook pers. comm. 2002, cited in USFWS 2003a). Overall breeding population losses of CTS from road kills have been estimated to be from 25-72% (Twitty 1941; S. Sweet in litt 1993, cited in USFWS 2003a; Launer and Fee 1996, cited in USFWS 2003a). Cook and Northen (2004) also noted CTS deaths from storm drains on roads near a breeding pond in an urban area. Other impacts of roads include mortality from road construction, modification of animal behavior, home range shifts, altered movement patterns, altered reproductive success, altered escape response, and altered physiological state. Roads also facilitate dispersal (by humans) of exotic species (such as non-native tiger salamanders) and increased human use of an area (Trombulak and Frissell 2000).

The Department considers the effects of habitat fragmentation and direct mortality due to roads to be a significant impact to CTS populations.

Predation and Competition from Native and Non-Native Animals: The petition adequately documents predation and competition from native and non-native birds, reptiles, amphibians, and fishes. Several non-native predatory fishes and the non-native bullfrog (*Rana catesbeiana*) are now widespread in CTS current and historical habitat (Shaffer et al. 1993). Non-native predatory fishes include members of the sunfish (Centrarchid) family popular with anglers such as largemouth bass (*Micropterus salmoides*), redear sunfish (*Lepomis microlophus*), and bluegill (*Lepomis macrochirus*). Shaffer et al. (1993) found a negative correlation between the presence of fishes or bullfrogs and the presence of CTS. Fisher and Shaffer (1996) found that native amphibians, including CTS, tend not to co-occur with introduced fishes and bullfrogs. They also found that since these introduced exotic species occupied low-elevation sites, native species were relegated primarily to higher elevations.

Bobzien's (2003) survey data from 275 ponds on 96,000 acres (150 mi^2; 388 km^2) suggest that exotic predators like sunfishes, catfishes (*Ictalurus* spp.) and bullfrogs are a significant factor in contributing to local declines of CTS. Semlitsch (2002) summarized information indicating that in situations where predatory fishes have been introduced to amphibian breeding habitat, especially ponds that persist for more than two years (e.g., stock ponds), the majority of amphibian species (whose larvae lack antipredatory behavior or skin toxins) are eliminated. Fisher and Shaffer (1996) found a significant, inverse relationship between introduced exotics, such as bullfrogs, sunfishes and mosquitofish, and native amphibians in the Central Valley. They found that although native and introduced species do sometimes co-occur, the vast majority of ponds harboring native amphibians lack introduced species. The relationship between mosquitofish (*Gambusia affinis),* widely stocked in water bodies for mosquito control, and CTS survival, also appears to be a negative one. Mosquitofish stocked in an experiment reduced growth and survival of CTS larvae and delayed metamorphosis via competition for food (Leyse 2000).

The Department concurs with the petition and various CTS experts and habitat managers that predation and competition by predatory non-native fishes and amphibians which are well-established throughout the range of the CTS, are important factors in the decline of CTS (e.g., Shaffer et al. 1993, Jennings and Hayes 1994, Fisher and Shaffer 1996, Bobzien 2003, Cook and Northen 2004). Unless introductions of these non-native species are curtailed and existing populations are actively removed from CTS habitat, their continued presence likely precludes CTS use of these habitats.

Hybridization with Non-Native Tiger Salamanders: The petition, using Shaffer et al. (1993) and Shaffer and Trenham (2002), documents hybridization of CTS with several subspecies of non-native tiger salamanders (*Ambystoma tigrinum* ssp.). *A. tigrinum*, formerly used as fishing bait, has become established as wild populations in various locations (Trenham et al. 2000, Riley et al. 2003). As of December, 2000, it is no longer legal to use *A. tigrinum* as bait or possess waterdogs anywhere in California (California Code of Regulations, Title 14, Division 1, Subdivision 1, Chapter 2, Article 3, Section 4.00, 2000). This regulation change was made by the Fish and Game Commission to protect CTS from hybridization by further spread of *A. tigrinum* via deliberate or accidental release of waterdogs into state waters. Several *A. tigrinum* population locations are identified in the petition.

Shaffer et al. (1993) first documented interbreeding between CTS and *A. tigrinum*. Shaffer and Trenham (2002) sampled 46 salamander populations southern Santa Clara, eastern Merced, San Benito, and northern Monterey counties, and documented 16 populations of hybrids. Figure 14 illustrates the locations of currently known populations of pure and hybridized non-native tiger salamanders and CTS. Hybrids are established on public and private lands (e.g., all Ft. Hunter Liggett populations, a pond at Lompoc Federal Penitentiary, the proposed site of new; U. C. Merced campus, the remote Gloria Valley on the San Benito/Monterey county line; Laabs et al. 2001, Shaffer and Trenham 2002). Four populations of pure *A. tigrinum* were located in Monterey County (Shaffer and Trenham 2002). The known range of hybridization extends for over 99 mi (160 km) in a north-south direction at least from Santa Clara to San Luis Obispo counties (Riley et al. 2003). Riley et al. (2003) found that these species are essentially biopollution and pose a serious threat to CTS, since they are interbreeding with CTS in the wild and producing viable and fertile offspring.

Elimination of these genetically impure populations will likely be very difficult due to the geographic extent of the invasion, the fact that they occur predominantly on private lands, the longevity of adult salamanders, and their habit of spending most of their lives in secluded underground retreats (Riley et al. 2003, Shaffer and Trenham In Press).

The Department believes that the presence of established pure *A. tigrinum* and hybrid tiger salamander populations in California is an imminent and serious threat to the CTS which has increased in magnitude since the species was first proposed for state listing in 2001.

Figure 14

Disease: The petition documents several diseases that affect other species of tiger salamanders, including bacteria, fungi, and viruses (e.g., Worthylake and Hovingh 1989, Kiesecker and Blaustein 1997, Lefcort et al. 1997, Jancovich et al. 2001). The petition presents no evidence of diseases that specifically affect CTS, but states that because of the rarity and isolation of CTS populations, disease may be of great concern. Several infectious diseases have been implicated in amphibian population declines, including ranaviral disease of the Sonoran tiger salamander (*A. tigrinum stebbinsi*), a federally endangered subspecies in Arizona (Daszak et al. 1999). Jancovich et al. (2001) suggested that one of the potential sources of the Sonoran tiger salamander viral infection was non-native salamanders introduced as bait. Viruses carried by fish may also affect salamanders (Carey et al. 2003). Chytridiomycosis, a fungal disease that can result in significant die-offs of larvae, has been found in at least seven California amphibian species (Carey et al. 2003). The Department finds that although disease does not currently appear to be a threat to CTS populations, it could emerge as one in the future as more research is conducted on disease and mortality of amphibian populations.

Contaminants: The petition named a wide variety of contaminants including agricultural chemicals (pesticides, herbicides, fungicides, and nitrogen fertilizers), road run-off oil and sedimentation, several petroleum-based pesticides, rodenticide anticoagulants, and non-petroleum mosquito controls (e.g., *Bacillus thuringensis israeli* [BTI] and methoprene) used in counties known to have CTS populations. However, the petitioners failed to analyze the risk by crop, timing of application, or application site in relation to known CTS habitat. The petition also failed to note that the Endangered Species Program at the California Department of Pesticide Regulation (CDPR) has developed a County Bulletin Program which outlines use recommendations for application of pesticides that may pose a threat to federally listed species, and that there are county bulletins for protection of CTS in the two counties where they have been federally listed (R. Hosea pers. comm.).

The petition failed to take into account whether applications of the referenced pesticides correspond with times when adult or larval stages of CTS may be present. Timing of applications is one of the key elements used in the County Bulletins developed by the CDPR Endangered Species Program. The petition failed to analyze the reported data in a manner that identifies whether pesticide usage for agricultural or landscape maintenance activities occur in or near CTS habitat, as opposed to being significantly removed from CTS habitat. The petition included pesticides used for structural pest control (treatment of houses or other buildings for pests such as termites or ants) which are characteristically not applications that should pose a significant risk to CTS.

The use of BTI for control of mosquitoes or other aquatic insects could have some indirect impact on CTS by reducing their prey base; however, the petition offered no documentation of these impacts within CTS habitat. Evidence for direct negative effects to salamanders is presented only for road run-off oil (USFWS 2000) and for methoprene (an insect hormone that inhibits molting). Exposure of amphibians to methoprene and s-methoprene has been linked to increased incidents of malformations in the scientific literature. It is possible that use of methoprene as a mosquito control agent may pose a risk to CTS during their larval stage and to adults present in breeding ponds and ephemeral wetlands if applications of this pesticide occur when animals are present. Heightened mosquito control resulting from the recent threat of West Nile virus may result in additional impacts to the invertebrates which form the CTS prey base.

Additional studies need to be conducted or cited that incorporate actual field conditions to confirm the preliminary findings identified in the literature (R. Hosea pers. comm.). Boone and James (2003) found that the insecticide carbaryl virtually eliminated spotted salamanders (*Ambystoma maculatum*), an eastern species. However, this chemical is not one of those listed in the petition as used within the range of CTS. In an analysis of pesticide drift as a potential cause for the decline of eight species of California amphibians, Davidson et al. (2002) found that declines of four species were strongly associated with the amount of upwind agricultural land use, but that for CTS, the decline was strongly associated with habitat alteration and to a lesser extent agricultural land use.

The Department's Pesticide Investigations Laboratory (PIU) has one record of an incident involving CTS and carbofuran, an insecticide not mentioned in the petition. The PIU has data on a tiger salamander recovered dead from a vineyard near King City, Monterey County, in 1992. It was determined that the salamander died as a result of exposure to carbofuran. The vineyard had been treated with carbofuran immediately prior to the recovery of the animal. The salamander was not submitted for identification to determine if it was a California subspecies, the eastern subspecies, or a hybrid. This is the only incident in the PIU incident database which involved tiger salamanders (R. Hosea pers. comm.).

Negative effects of the other contaminants are inferred based on their toxicity to fishes or the possible reduction in availability of salamander prey. Lefcort et al. (1997) found that two relatives of the CTS from the eastern United States, the marbled salamander (*Ambystoma opacum)* and Eastern tiger salamander (*A. tigrinum tigrinum*), were not deleteriously affected by direct exposure to used motor oil, even at concentrations of oil equivalent to service station runoff (100 mg/liter). However, salamanders appeared to be indirectly affected when their food chain included the contaminated algae exposed to oil - these salamanders showed significantly less growth than controls (i.e., salamanders whose food chain did not include contaminated algae). Other studies have shown toxicity of other contaminants on invertebrates (e.g., Lawrenz 1984). CTS eat invertebrates and reduction of invertebrate numbers due to contaminants could decrease the available food supply and cause decreased salamander growth.

The petition cites use of chlorophacinone and diphacinone as a significant threat to CTS. The majority of uses of both chlorophacinone- and diphacinone-treated baits are for control of ground squirrels, where the bait is characteristically placed in bait stations, and exposure of CTS to the chemicals is not very likely. The bait may also be broadcast at a rate of two to four treated grains per square foot of ground. The probability of CTS coming in contact with a sufficient number of treated grains to dermally absorb a lethal dose of either of these anticoagulants is extremely unlikely. CTS are not granivorous and therefore would not be expected to ingest any of the treated grain. In many counties bait stations have been modified or elevated to exclude kangaroo rats. These modifications will also effectively exclude CTS. Bait stations are also relatively widely spaced which would also work to minimize the probability that migrating CTS would actually encounter one (R. Hosea pers. comm.).

The Department concludes that carbofuran, methoprene and BTI may pose risks to CTS, but that additional information is necessary. Information presented in the petition about other potential contaminants was insufficient to indicate deleterious effects on CTS.

Agricultural Practices: The petition presents a detailed discussion on the negative effects on CTS by grazing due to direct trampling of individual CTS and burrows, habitat modification, and through destruction of vernal pool habitat. The petitioners state that healthy CTS populations may be compatible with livestock grazing under certain seasonal and intensity regimes and without detrimental practices such as introduction of exotic predators, discing, and rodent control. Given widespread, non-native annual grasses, an appropriate level of grazing is important for the maintenance of vernal pools (California Fish and Game 1999). Grazing may be beneficial through preventing invasion of grasslands by shrubs and by creating conditions that favor higher densities of ground squirrels and kangaroo rats. Also, many current CTS populations use stock ponds created and maintained by ranchers that would not be in the landscape without grazing. Many breeding sites in the Bay Area population are also in artificial water bodies – the USFWS (2003) found that 43% of CNDDB records were in stock, farm, or berm ponds used for cattle grazing and as a temporary source of water for small farm irrigation. However, conversion of open or grazing land to intensive agriculture results in habitat destruction and fragmentation detrimental to CTS (USFWS 2003a).

The Department concurs with the petition's equivocal evaluation of grazing impacts to CTS. Grazing of grassland habitat and maintenance of associated stock or other ponds can be beneficial to CTS by providing and maintaining breeding and upland habitat that would not otherwise exist. However, we recognize that many of these artificial ponds contain non-native predators and competitors, such as bullfrogs and centrarchid fishes, that preclude use of the ponds by CTS. The Department also agrees that discing ponds or introduction of exotic predators is incompatible with CTS use, and rodent control to prevent livestock injuries may affect CTS by eliminating subterranean estivation habitat (see discussion below re rodenticides).

Other Factors: The petition cites illegal grading, plowing, filling of ponds, and rodent control practices. Small preserves, especially those in close proximity to housing or commercial developments, are particularly susceptible to human impacts. For example, Clark et al. (1998) reported fences around a small vernal pool preserve

(Phoenix Park Vernal Pool Preserve) in an urban setting were vandalized to allow unauthorized and destructive access (i.e., use of motorized vehicles) to the preserve. Clark et al. (1998) also mentioned several other management issues related to small preserves, including foot, horse and bicycle traffic, plant and animal collection, herbicide or pesticide oversprays, changes in hydrology, litter, invasive exotic plants, and feral and domestic animals. Cook and Northen (2004) observed several urban-related threats to a small reserve CTS population, including urban encroachment on all existing terrestrial habitat, road mortality from vehicle collisions and storm drains, probably increased predation from urban avian predators, and larval mortality from shortened pool hydroperiod caused by hydrological changes in the pool watershed.

The Department agrees that human impacts can be a significant problem at preserve sites, especially small preserves.

The petition discusses potential direct negative effects of rodenticides on CTS as well as indirect negative effects resulting from rodent control practices and associated loss of rodent burrows salamanders use for shelter. No evidence of direct effects of rodent control chemicals was presented. Presence of California ground squirrel burrows is positively correlated with presence of CTS (Seymour and Westphal 1994, Loredo et al. 1996). The likely commensal relationship between California ground squirrels and CTS has important conservation implications. The petition cited a reference stating that ground squirrel control occurs on nearly 1 million acres (4,047 km$^{2)}$ in California. According to more recent information from the California Department of Food and Agriculture, however, California ground squirrels are currently controlled (i.e., poisoned or otherwise killed) on approximately 300,000 total acres (1,214 km^2) [approximately 1% of the 27.7 million acres (1,120,984 km^2) under agricultural production in the State] (CDFA 2003).

The Department concurs that California ground squirrel control efforts may indirectly negatively affect some CTS populations by eliminating or reducing subterranean estivation habitat.

Degree and Immediacy of Threat (“Nature and Degree of Threat” in Petition)

The petition states that generally, modification or destruction of habitat is the primary threat to CTS. The petition states that conversion of open or grazing land to urban and intensive agricultural uses is the primary land use change that threaten CTS. Based on approximate measurements on the Kuchler (1997) vegetation map, Shaffer et al. (1993) estimated that at least 75% of historical grassland habitat in the Central Valley used by CTS has been lost. Shaffer et al. (1993) also mentioned that:

“[i]t is important to note that the current configuration of CTS habitat is a narrow strip [emphasis by author] *fringing the Central Valley, making the isolation of populations from each other much more likely than was previously the case. This is especially true as*

urban centers like Fresno, Madera, and Sacramento expand off of the valley floor and into the Sierra foothills, cutting off section of grassland habitat to the north and south. As this continues to occur, once-continuous sections of habitat will be ever further isolated and subdivided, and increasingly subject of environmental catastrophes and local extirpation. And under these conditions of isolation, recolonization from other areas becomes increasingly difficult or impossible."

Due to projected population growth and continued habitat loss and fragmentation, additional losses of CTS populations can reasonably be expected absent the provision of legal protection for the species. The petition lists specific development projects that potentially threaten CTS habitat throughout its range. The Department agrees that although much of the loss of CTS habitat has occurred in the past, CTS habitats will continue to be eliminated and fragmented by urban expansion since existing regulatory mechanisms do not adequately protect CTS populations and habitat (see Impact of Existing Management Efforts, below). Based on our analysis discussed above under Factors Affecting Ability to Survive and Reproduce and depicted in Figure 13, the threat of continued loss of CTS habitat to development appears to be greatest in the Central Valley and southern San Joaquin Valley populations.

Introduced species are presented by the petitioners as a significant threat to CTS throughout most of the current range. The Department found that there is ample evidence that introduced species, including bullfrogs and sunfishes, have a significant negative effect on CTS populations, particularly in the low elevation areas of the Central Valley (e.g., Shaffer et al. 1993, Seymour and Westphal 1994, Jennings and Hayes 1994).

Established populations of non-native *A. tigrinum* (i.e., "waterdog") and of hybrid *A. tigrinum/A. californiense* pose a considerable threat to CTS in the Central Coast and Bay Area populations, and a potentially major threat to the South San Joaquin population. Hybrid or pure non-native tiger salamanders are widespread among known localities of CTS in the Central Coast and Bay Area populations. Acreages of potentially suitable CTS habitat (Table 2) in these two populations threatened by hybridization constitute 60% of CTS potentially suitable habitat range-wide.

All populations of CTS have been listed by the USFWS as Endangered due, primarily, to loss and fragmentation of habitat.

Impact of Existing Management Efforts ("Current Management" and "Nature and Degree of Threat" in Petition)

The petition names two general categories of protective measures – Federal, and State and Local - and presents evidence that each is inadequate for protection of CTS. The Federal section is subdivided into 1) proposed listing of Central California DPS as threatened under FESA, 2) final listing under FESA as Threatened would provide inadequate protection rangewide, 3) final listing as FESA Endangered does not remove the need for listing under CESA, 4) Federal listing of other species within the range of the CTS provides inadequate protection, and 5) Section 404 of the Clean Water Act does not provide adequate protection.

Federal management

Federal Endangered Species Act (FESA): The petition states that FESA is inadequate to protect non-listed populations of CTS even when CTS inhabit waters with FESA listed species, and that preservation of aquatic habitat does not address the upland habitat that CTS require. Subsequent to submission of the petition, however, all populations of CTS have been Federally listed. The petition also points out that there are other species listed under FESA that occur in association with seasonally flooded vernal pools (USFWS 2003a). The California red-legged frog (*Rana aurora draytonii*) (CRLF) is a federally-listed species that breeds in various, usually permanent, sources of water (e.g., Stebbins 1985), whose breeding sites can co-occur with CTS to a limited degree. For example, in 275 ponds on East Bay Regional Parks lands, CRLF co-occurs with CTS in only in 39% of ponds (Bobzien 2003). The petition also cites the USFWS' (2003) statement that overlap between these protected species and CTS is limited, and where there are co-occurrences, CTS upland habitat is not adequately protected. Figure 15 illustrates the occurrence of CTS relative to CRLF and vernal pool species critical habitat.

The Department agrees that existing federally-listed species do not provide adequate protection to CTS upland habitat.

Clean Water Act: The petition provides a detailed discussion explaining why the Clean Water Act (CWA) does not adequately protect the small wetlands that are critical for CTS habitat. In combination with the USFWS (2003) analysis, it is clear that the CWA does not adequately protect CTS, especially with regard to loss of both numerous small wetlands and maintenance of connectivity among wetlands.

State and Local Management

The petition correctly states that the CTS' designation as a California Species of Concern (CSC) has been inadequate to protect the species. There is confusion, however, about what designation as a CSC species means. The CSC title does not confer any legal status, as implied by Cook and Northen (2001), cited in the petition. The CSC designation is an administrative one, used by the Department and others for those species determined to be in decline, but that have not yet been determined to warrant listing under California Endangered Species Act. The CSC designation is intended to alert agencies, land managers, biologists, and academia about the declining status of CSC species to encourage research, special management efforts, and consideration under Section 15380 of the California Environmental Quality Act (CEQA) Guidelines. The

Figure 15

lead agency determines whether CTS are included in the environmental document. When included in environmental documents, mitigation afforded to CTS (and other CSC species) is variable. CEQA does not in and of itself dictate mitigation ratios. Mitigation decisions depend on the lead agency and its judgment as to whether a project's adverse impacts on CTS are potentially significant under CEQA and can feasibly be mitigated or avoided. The CSC designation has proven effective in many cases for various species, but clearly has not proven adequate by itself to ensure consideration and mitigation under CEQA for the CTS.

The petition discusses several large-scale planning efforts (e.g., Habitat Conservation Plans - HCP, Natural Community Conservation Plans - NCCP) under development within the range of the CTS. Although CTS is currently listed as a covered species in these plans, inclusion and extent of protection of breeding and upland habitat will not be certain until each plan is finalized. Plans in progress are sometimes abandoned. For example, the Eastern Merced County NCCP mentioned in the petition, is no longer underway.

The petition mentions various State, Federal and other lands which afford some protection to CTS. The Department, using GIS analysis, determined that just under 1.8 million acres (7,284 km^{2}) of "protected" lands occur within the range of CTS (Table 3). Figure 16 illustrates these lands, identified by ownership, relative to known CTS localities.

Table 3. Acreage of public, military and other lands which may afford protection to CTS.

Ownership	**Total Public Lands**	**Bay Area**	**Central Coast**	**Central Valley**	**San Joaquin Valley**	**Sonoma**	**Santa Barbara**
Federal	858,261	167,101	527,438	131,253	32,147	0	322
Military Base	264,046	715	210,725	45,453	2,023	0	5,131
State	294,304	139,110	34,330	108,109	12,086	663	6
Local	185,376	69,745	23,633	91,980	0	18	0
NGO/Other	166,900	74,620	20,744	68,649	2,841	0	47
Total	**1,768,887**	**451,291**	**816,870**	**445,444**	**49,097**	**681**	**5,506**

The petitioners identified approximately 102 breeding sites scattered throughout the range of CTS which could be considered protected now or in the near future. A total of 301 of 857 known CTS localities occur on the lands identified by the Department in Table 3, above. The petitioners point out, however, that many of these populations are vulnerable to various threats including isolation, exotic predatory species, and hybridization. For example, East Bay Regional Parks District manages 275 ponds, 61 of which are CTS breeding ponds. The presence of exotic predators reduces the number of total ponds suitable for CTS breeding and is a significant factor in contributing to local CTS declines (Bobzien 2003).

Figure 16

Public ownership helps somewhat to blunt the threat from habitat destruction, but many of these lands were not specifically designated for the conservation and management of CTS. Those that are, like Jepson Prairie Reserve in Solano County, for example, can support healthy populations of CTS. In contrast, all of the tiger salamander populations at Ft. Hunter Liggett have been discovered to be hybrids.

Although included in our calculation of protected lands, military lands are not necessarily managed for the benefit of wildlife – the military mission supersedes other uses. For those lands where CTS are specifically protected and managed, it is important to note that protecting some CTS populations from habitat loss and fragmentation associated with urbanization and agriculture does not necessarily ensure population persistence. For example, 13 species of amphibians in a small, isolated wetland that had been protected for over 30 years had annual reproductive failure rates of 42-56% over a 16 year period due to random events (Semlitsch et al. 1996). The Department concurs that the protection currently afforded CTS opportunistically on various existing public lands and reserves cannot be presumed to be adequate for overall conservation of the species.

Suggestions for Future Management

The petition lists preservation of habitat as the most important immediate and long-term need for CTS. Specifically, the petition states that the preserved habitat should include groups of two or more breeding pools and provide adequate terrestrial habitat. Priority should be given to preserving low elevation valley habitats since this is the habitat type that has been lost to the greatest degree. Jepson Prairie (Solano County) is cited as an example of a high quality valley habitat currently under protection. The Department concurs that protection of multiple pools with adequate estivation (upland) habitat is crucial to the long-term viability of CTS populations.

The petition recommends removal of non-native aquatic species in known or potential CTS habitats, including the cessation of fish stocking in known or potential CTS habitats. The Department does not stock the artificial ponds in which CTS may occur; however, it does currently issue permits to private landowners to stock such ponds with predatory game fishes. Seymour and Westphal (1994) demonstrated a significant negative correlation between CTS and bullfrogs (*Rana catesbeiana*). They also found a significant negative correlation between CTS and presence of either of two introduced fishes - mosquitofish or green sunfish (*Lepomis cyanellus).* The Department concurs that impacts of introduced species can seriously affect CTS populations and potential management options for CTS populations impacted by these species should be explored.

The Department recommends that options for the elimination or control of non-native and hybrid populations of tiger salamanders be explored and pursued as a high priority, and that genetic testing of populations continue as necessary.

The petition recommends examining the possibility of moving individual CTS between populations that are now isolated, but historically were connected. Genetic makeup must be taken into consideration before translocations occur.

The Department recommends that applicability of actions mentioned in the draft recovery plan for the Sonoran tiger salamander (*Ambystoma tigrinum stebbinsi*) (USFWS 1999) be explored. The plan includes such things as developing guidelines for cattle pond use and maintenance, developing cooperative agreements with willing landowners to protect salamander habitats on private lands, constructing more ponds, removing non-native predatory species, monitoring salamander populations and their habitats, and researching poorly- or unknown aspects of salamander ecology.

Summary of the Evaluation of the Petition

The petitioners recommend that the CTS be listed as Endangered throughout its range in California. Information presented by the petitioners, along with the Department's additional analysis and information obtained during the petition evaluation period, indicates that the CTS appears to be threatened by a variety of factors range-wide. Six genetically distinct populations exist. All six populations are now Federally listed as Threatened primarily due to loss, degradation, and fragmentation of habitat due to human activities. The Central Coast and Bay Area populations are also imminently threatened by hybridization with established, widespread populations of non-native tiger salamanders; hybrids have also been found in the southern portion of the Central Valley population. Projected human population growth and associated CTS habitat loss and fragmentation will continue to occur under existing regulatory mechanisms – these impacts will be most pronounced in the Bay Area, Central Valley and southern San Joaquin CTS populations. Existing public and reserve lands do not adequately protect known populations of CTS. The Department believes the petition, in combination with additional information and analysis, includes sufficient scientific information to indicate that the petitioned action may be warranted due to a variety of conservation problems and threats. The CTS appears to be subject to serious risk of endangerment throughout its entire range. We recommend that the Fish and Game Commission accept and consider the petition.

Availability and Sources of Information

The petition included lists of: 1) individuals supporting the petition action, 2) references, 3) personal communications, and 4) projects that may negatively affect existing or potential CTS populations.

In evaluating the petition, the Department used May 2004 CNDDB data, site-specific information from Department staff, published and unpublished information from various sources identified in the Literature Cited section, below, and communications with CTS experts.

Detailed Distribution Map

The petition included both a statewide distribution map and a map of the historic and current range of CTS within Sonoma County (excluding southern Sonoma County).

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Hosea, R. Environmental Scientist, Pesticides Investigation Laboratory, California Dept. Fish and Game, Rancho Cordova

Shaffer, H.B., Ph.D, University of California, Davis

Sweet, S., Ph.D., University of California, Santa Barbara

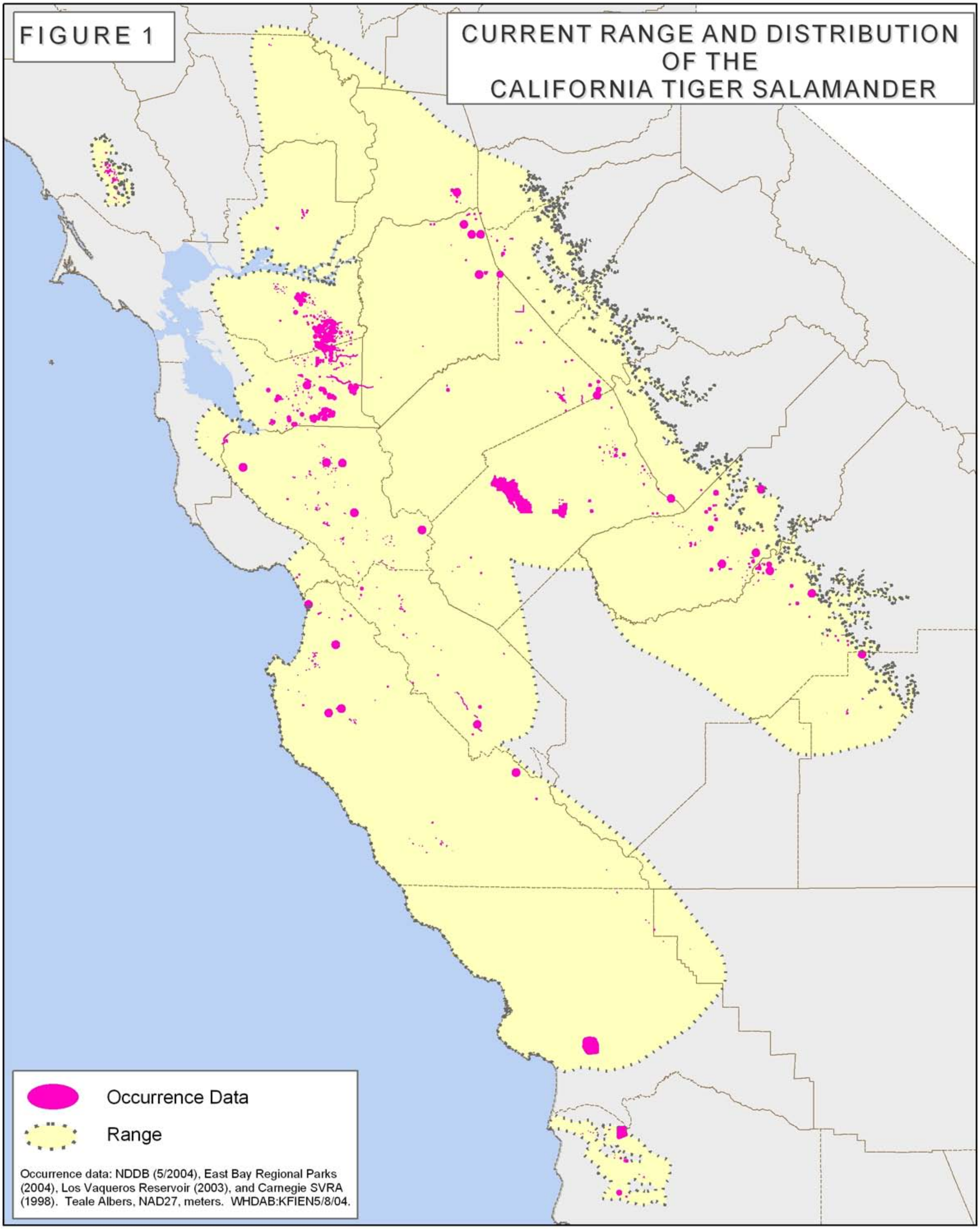


FIGURE 1
CURRENT RANGE AND DISTRIBUTION
OF THE
CALIFORNIA TIGER SALAMANDER
Occurrence Data
Range
Occurrence data: NDDB (5/2004), East Bay Regional Parks (2004), Los Vaqueros Reservoir (2003), and Carnegie SVRA (1998). Teale Albers, NAD27, meters. WHDAB:KFIEN5/8/04.

FIGURE 2

COMPARISON OF CALIFORNIA TIGER SALAMANDER RANGE BOUNDARIES DEVELOPED BY THE DEPARTMENT, CENTER FOR BIOLOGICAL DIVERSITY ET AL. (2004), AND URAM ET AL. (2003).

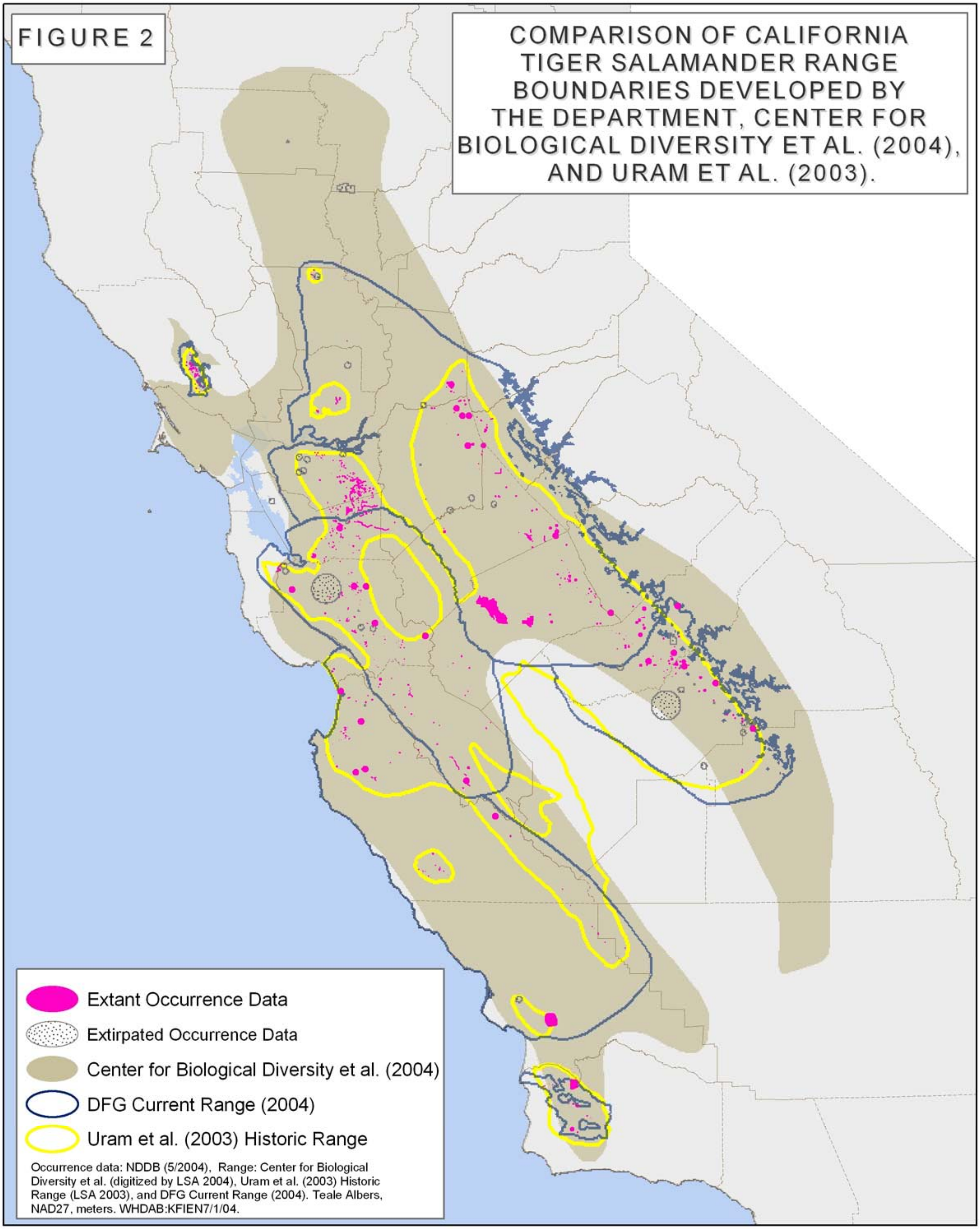


Figure 3. Historic and current distribution of the California tiger salamander (*Ambystoma californiense*) based on 383 locations from 769 museum records and 158 records from other sources (Jennings and Hayes 1994).

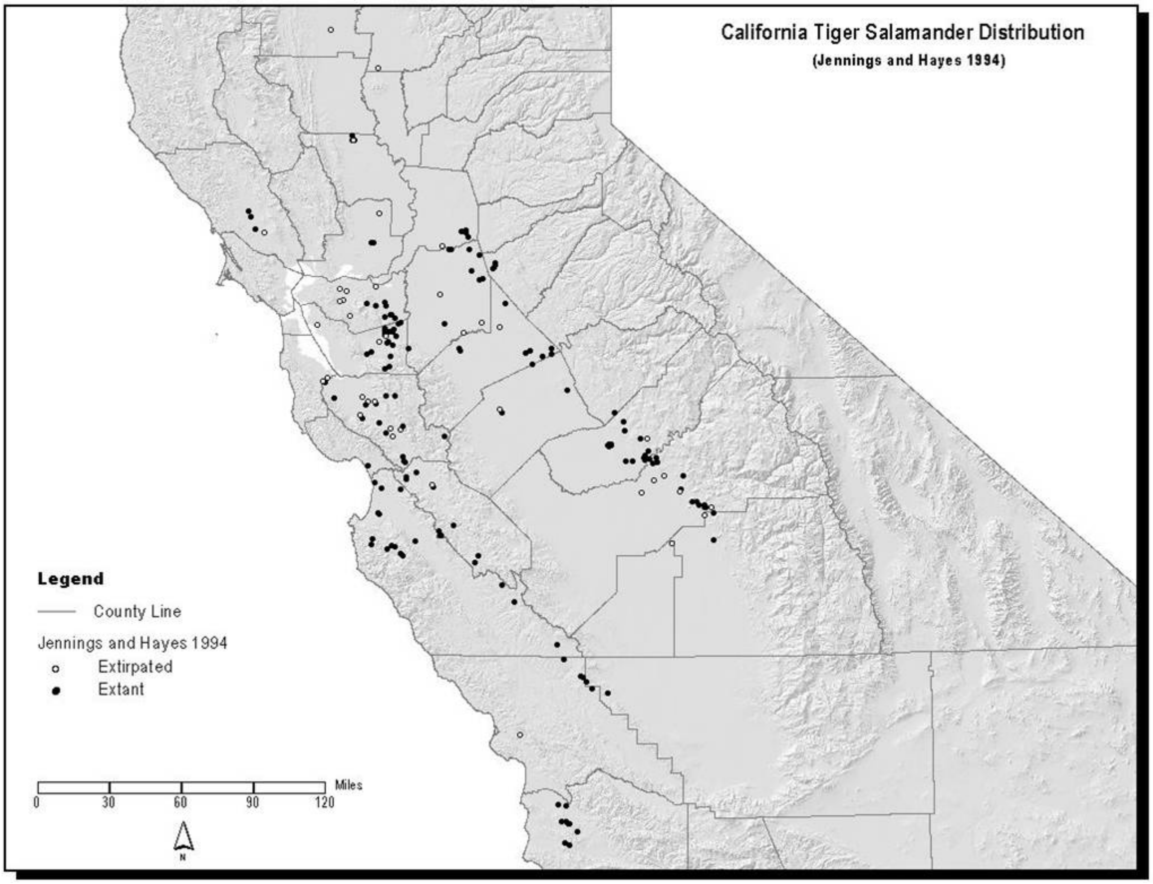
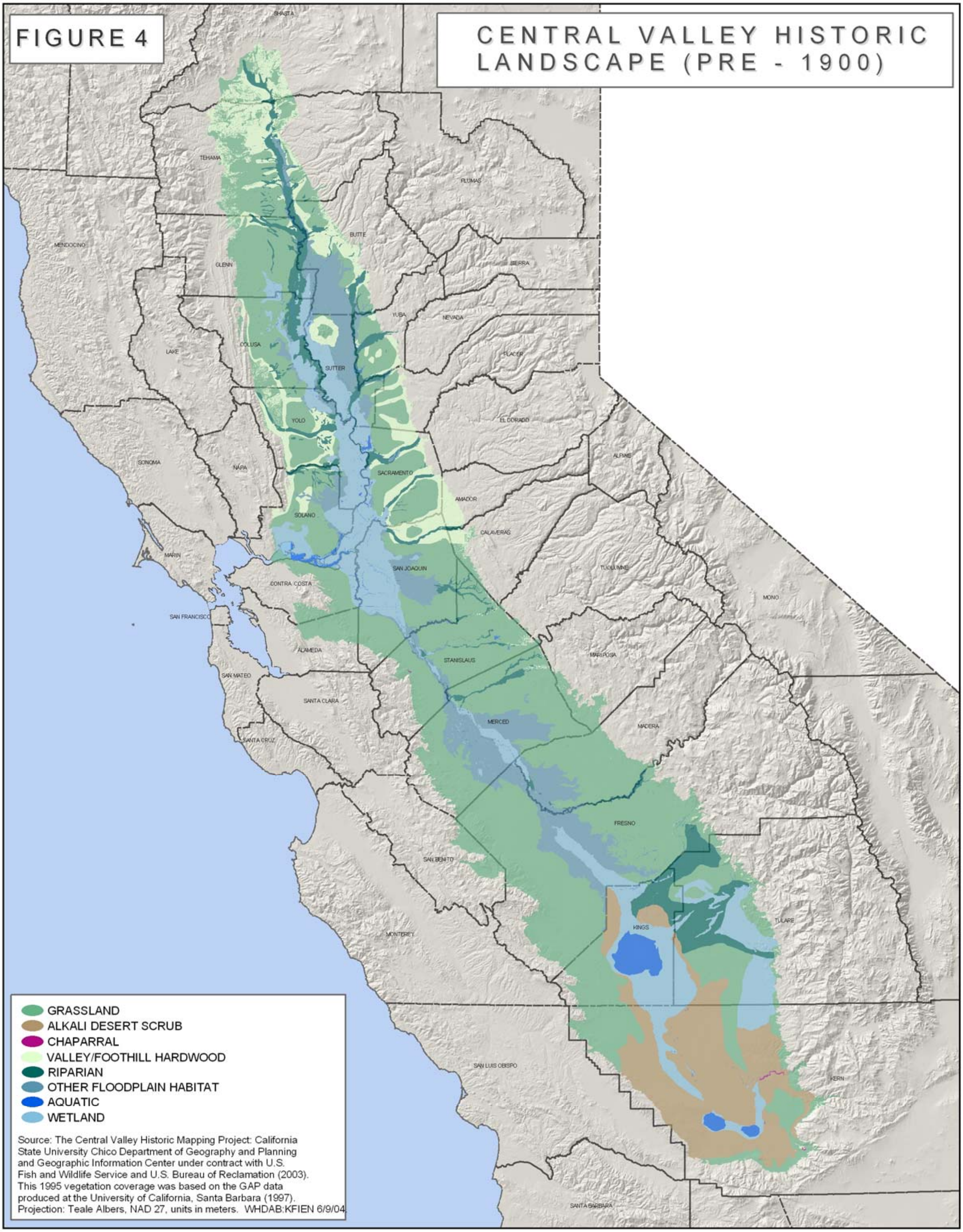


FIGURE 4

CENTRAL VALLEY HISTORIC LANDSCAPE (PRE - 1900)



Source: The Central Valley Historic Mapping Project: California State University Chico Department of Geography and Planning and Geographic Information Center under contract with U.S. Fish and Wildlife Service and U.S. Bureau of Reclamation (2003). This 1995 vegetation coverage was based on the GAP data produced at the University of California, Santa Barbara (1997). Projection: Teale Albers, NAD 27, units in meters. WHDAB:KFIEN 6/9/04.

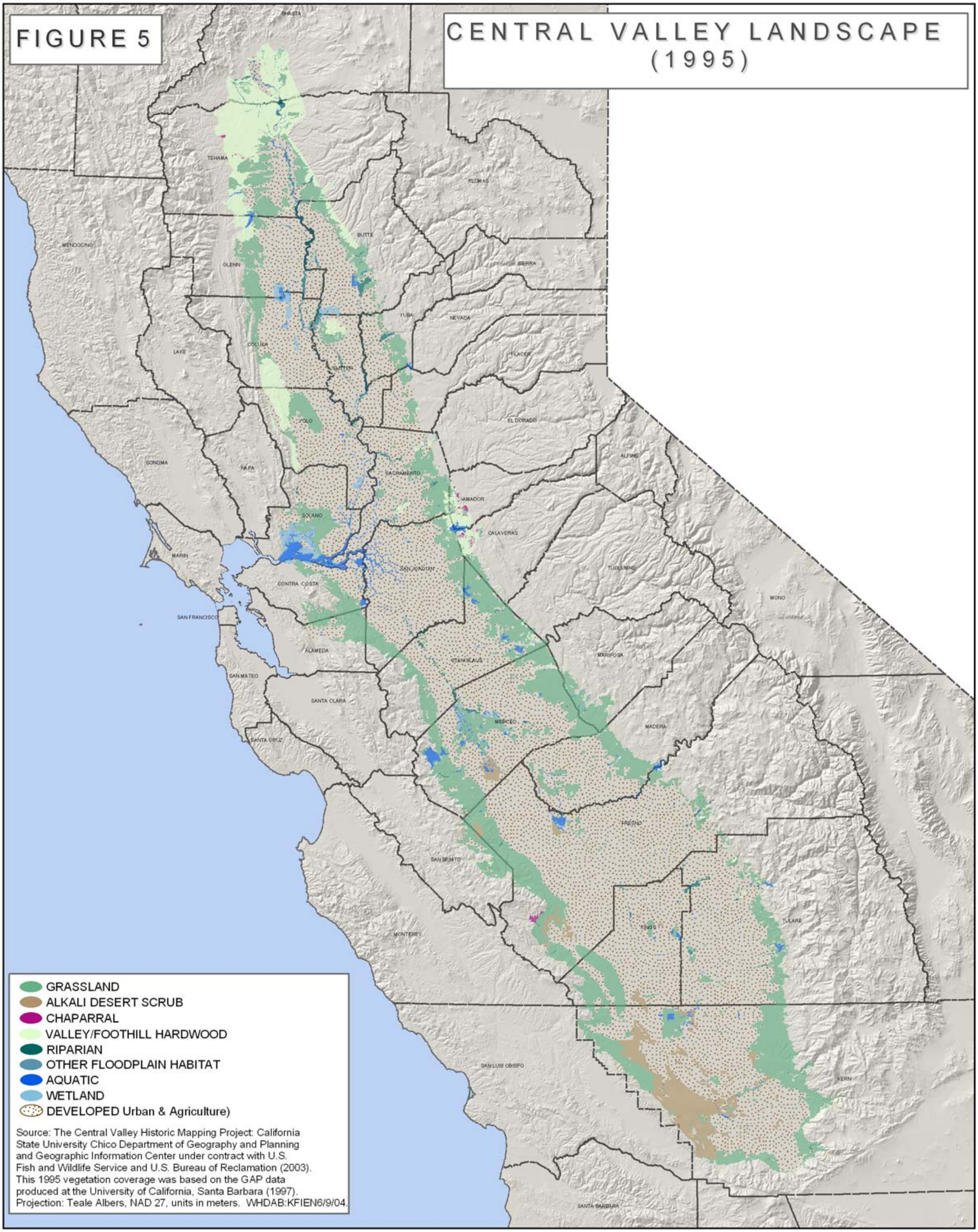


FIGURE 5

CENTRAL VALLEY LANDSCAPE (1995)

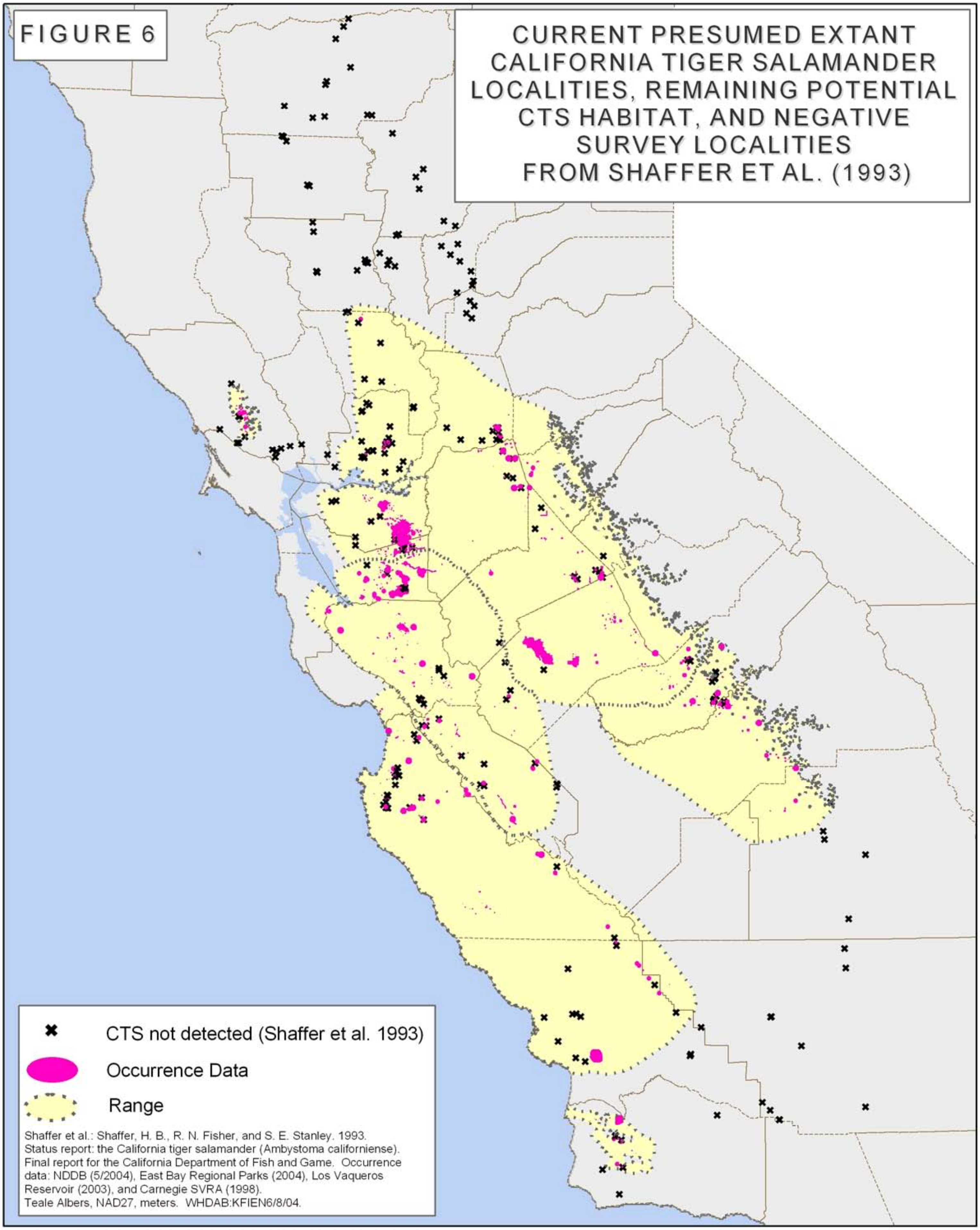


FIGURE 6
CURRENT PRESUMED EXTANT CALIFORNIA TIGER SALAMANDER LOCALITIES, REMAINING POTENTIAL CTS HABITAT, AND NEGATIVE SURVEY LOCALITIES FROM SHAFFER ET AL. (1993)
CTS not detected (Shaffer et al. 1993)
Occurrence Data
Range
Shaffer et al.: Shaffer, H. B., R. N. Fisher, and S. E. Stanley. 1993. Status report: the California tiger salamander (Ambystoma californiense). Final report for the California Department of Fish and Game. Occurrence data: NDDB (5/2004), East Bay Regional Parks (2004), Los Vaqueros Reservoir (2003), and Carnegie SVRA (1998).
Teale Albers, NAD27, meters. WHDAB:KFIEN6/8/04.

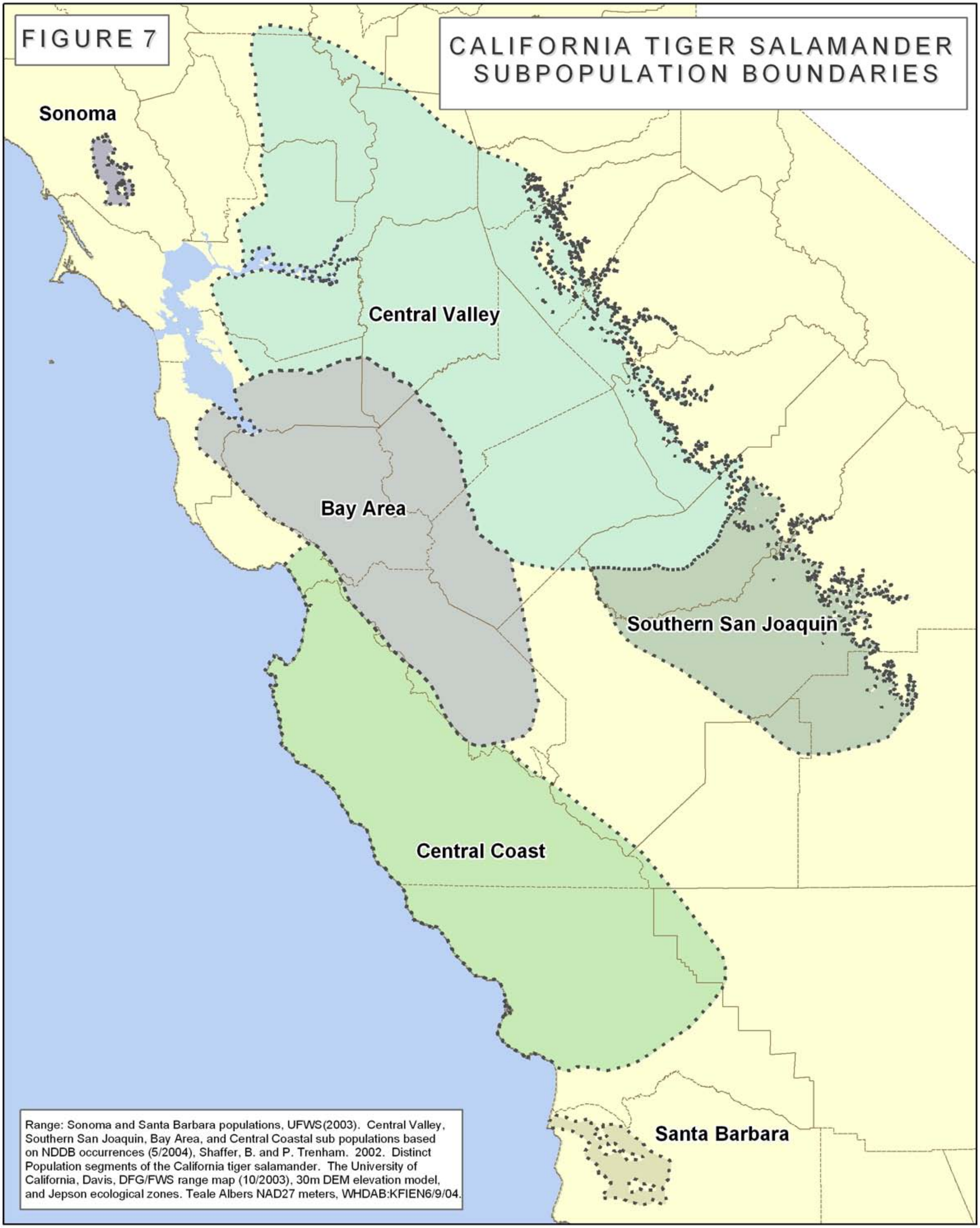


FIGURE 7
CALIFORNIA TIGER SALAMANDER SUBPOPULATION BOUNDARIES
Sonoma
Central Valley
Bay Area
Southern San Joaquin
Central Coast
Santa Barbara
Range: Sonoma and Santa Barbara populations, UFWS(2003). Central Valley, Southern San Joaquin, Bay Area, and Central Coastal sub populations based on NDDB occurrences (5/2004), Shaffer, B. and P. Trenham. 2002. Distinct Population segments of the California tiger salamander. The University of California, Davis, DFG/FWS range map (10/2003), 30m DEM elevation model, and Jepson ecological zones. Teale Albers NAD27 meters, WHDAB:KFIEN6/9/04.

Figure 8. California tiger salamander (*Ambystoma tigrinum*) (photo by Gerald and Buff Corsi).

Figure 9. Example of vernal pool habitat used by California tiger salamander (*Amybstoma californiense*).

Figure 10. Example of artificial pond habitat used by California tiger salamander (*Amybstoma californiense*).

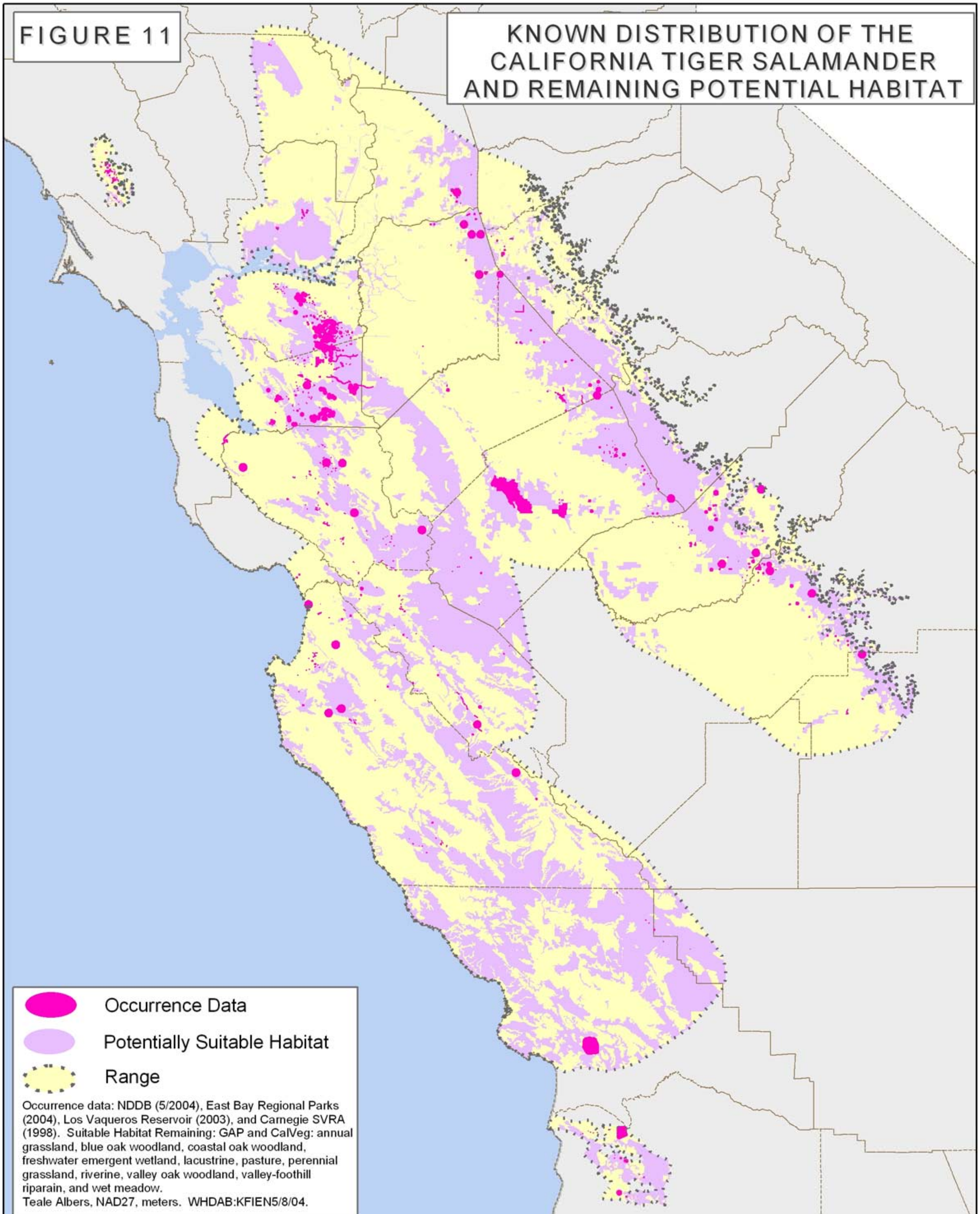


FIGURE 11

KNOWN DISTRIBUTION OF THE CALIFORNIA TIGER SALAMANDER AND REMAINING POTENTIAL HABITAT

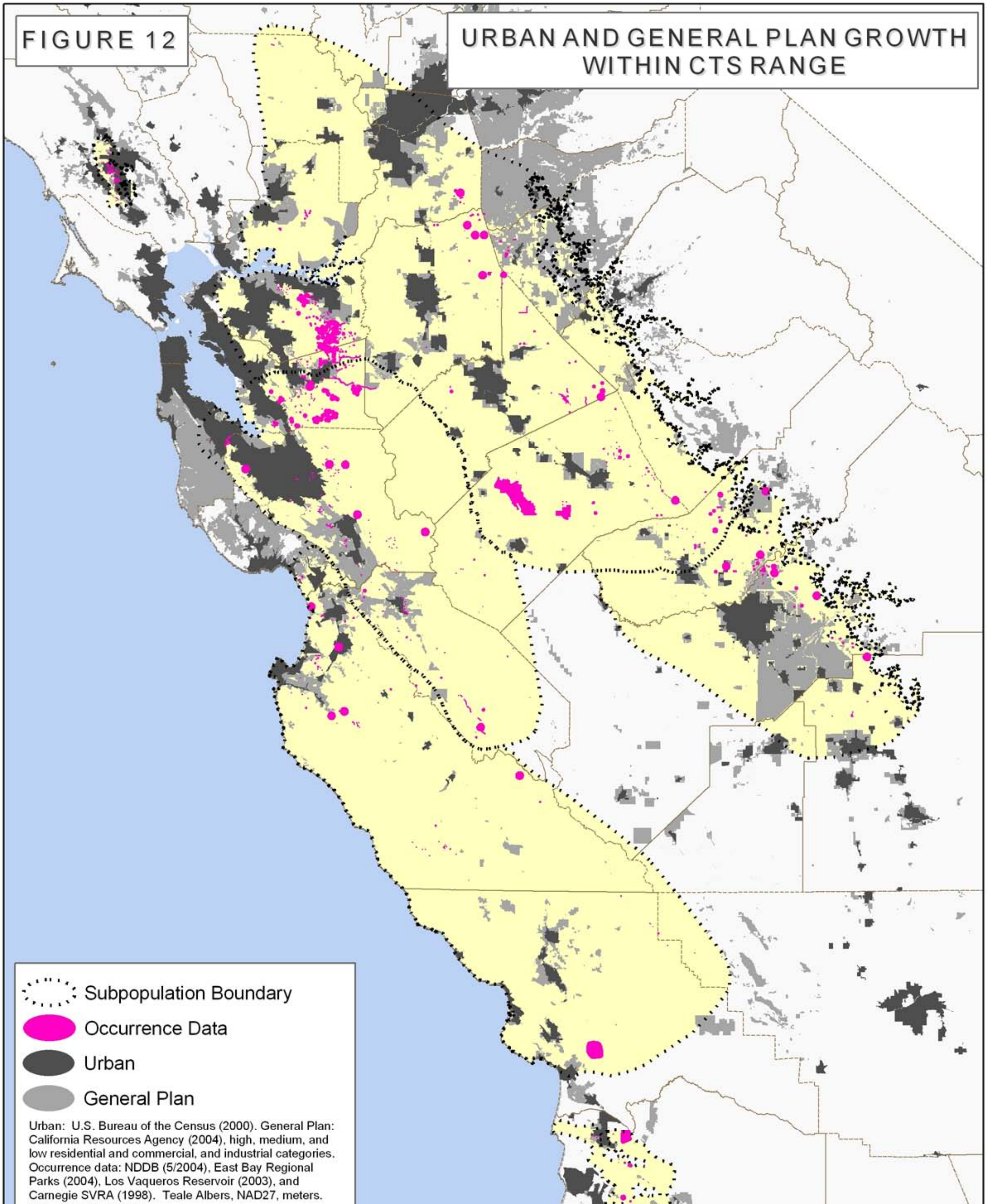


FIGURE 12
URBAN AND GENERAL PLAN GROWTH WITHIN CTS RANGE
Subpopulation Boundary
Occurrence Data
Urban
General Plan
Urban: U.S. Bureau of the Census (2000). General Plan: California Resources Agency (2004), high, medium, and low residential and commercial, and industrial categories. Occurrence data: NDDB (5/2004), East Bay Regional Parks (2004), Los Vaqueros Reservoir (2003), and Carnegie SVRA (1998). Teale Albers, NAD27, meters. WHDAB:KFIEN6/9/04.

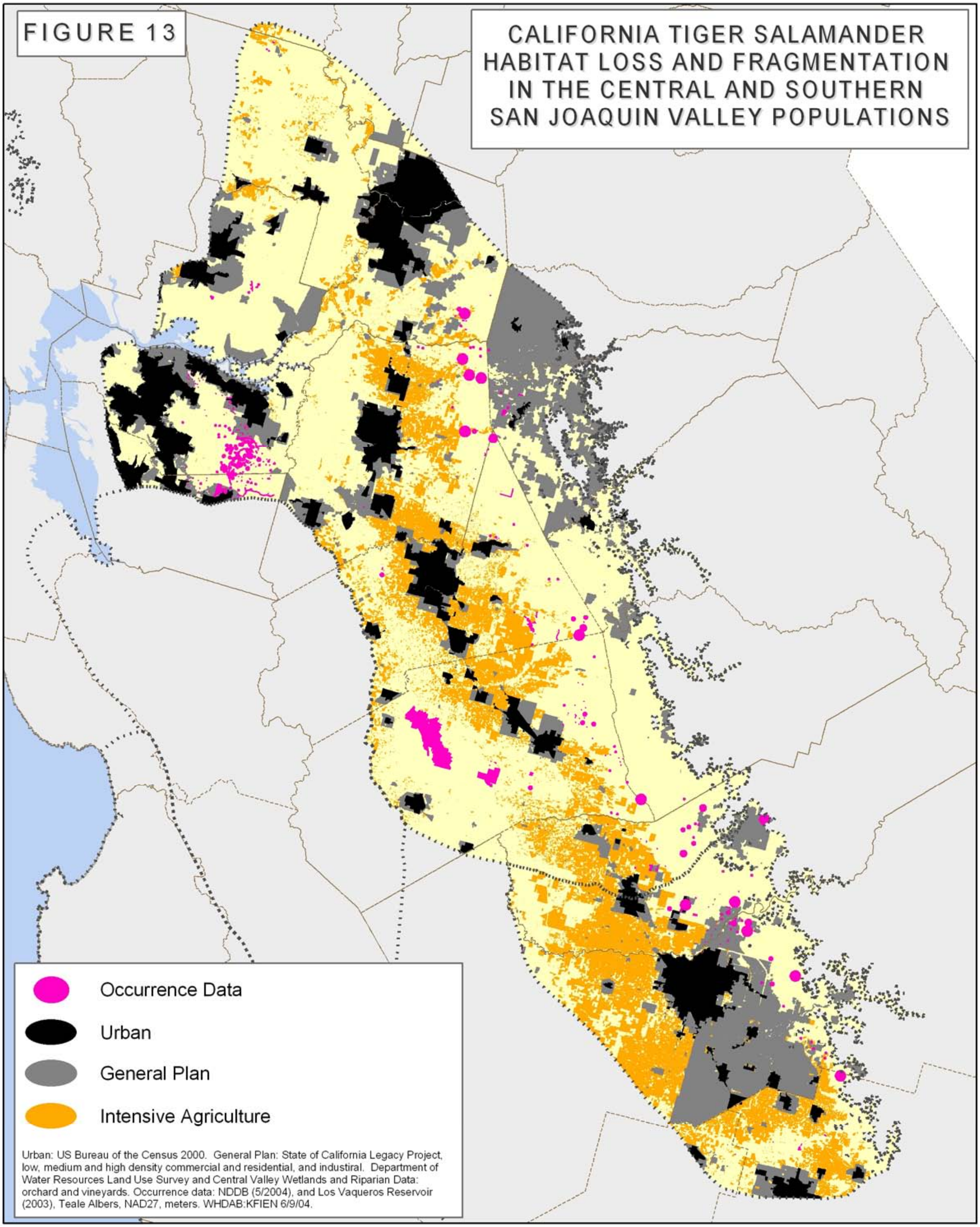


FIGURE 13

CALIFORNIA TIGER SALAMANDER HABITAT LOSS AND FRAGMENTATION IN THE CENTRAL AND SOUTHERN SAN JOAQUIN VALLEY POPULATIONS

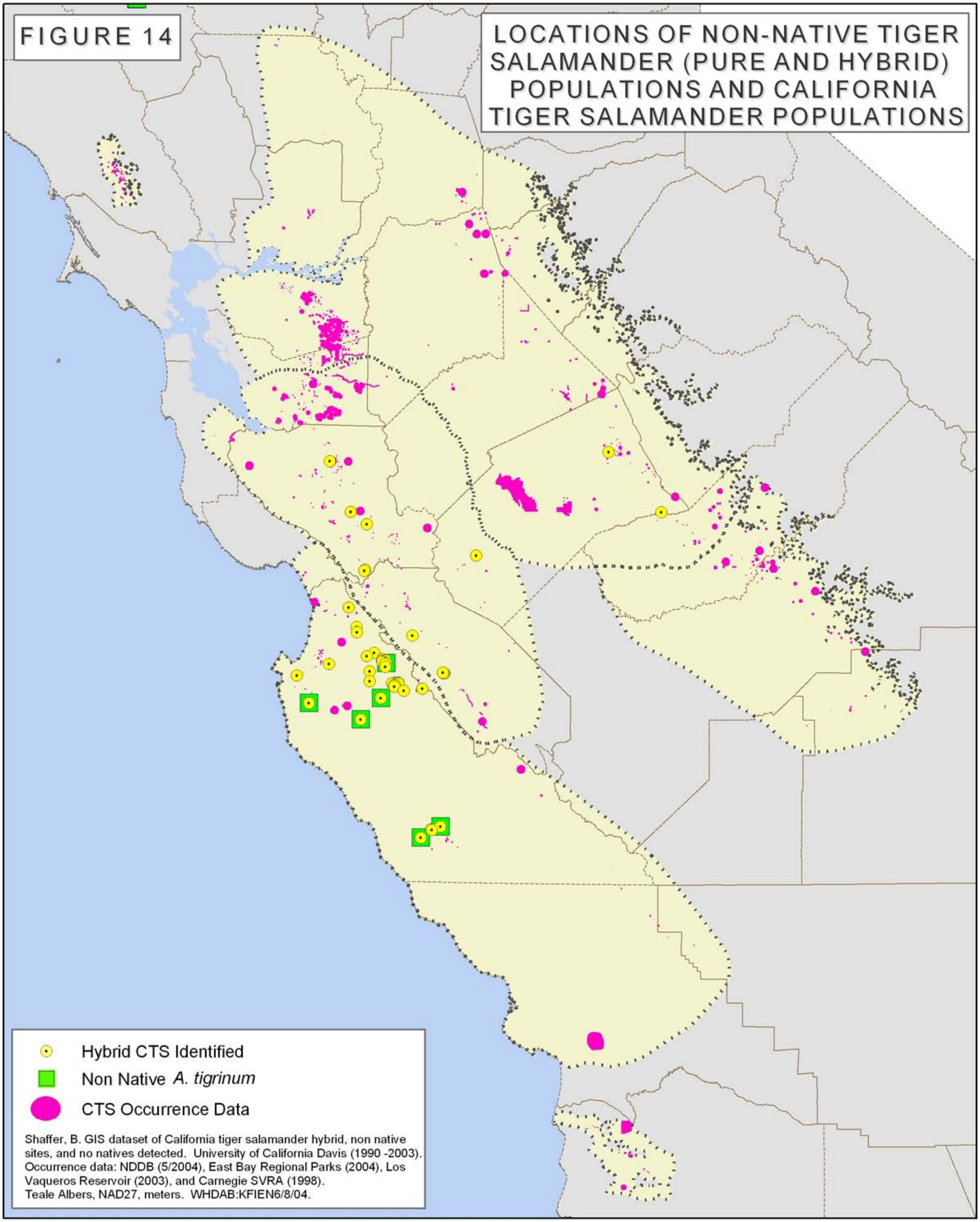


FIGURE 14

LOCATIONS OF NON-NATIVE TIGER SALAMANDER (PURE AND HYBRID) POPULATIONS AND CALIFORNIA TIGER SALAMANDER POPULATIONS

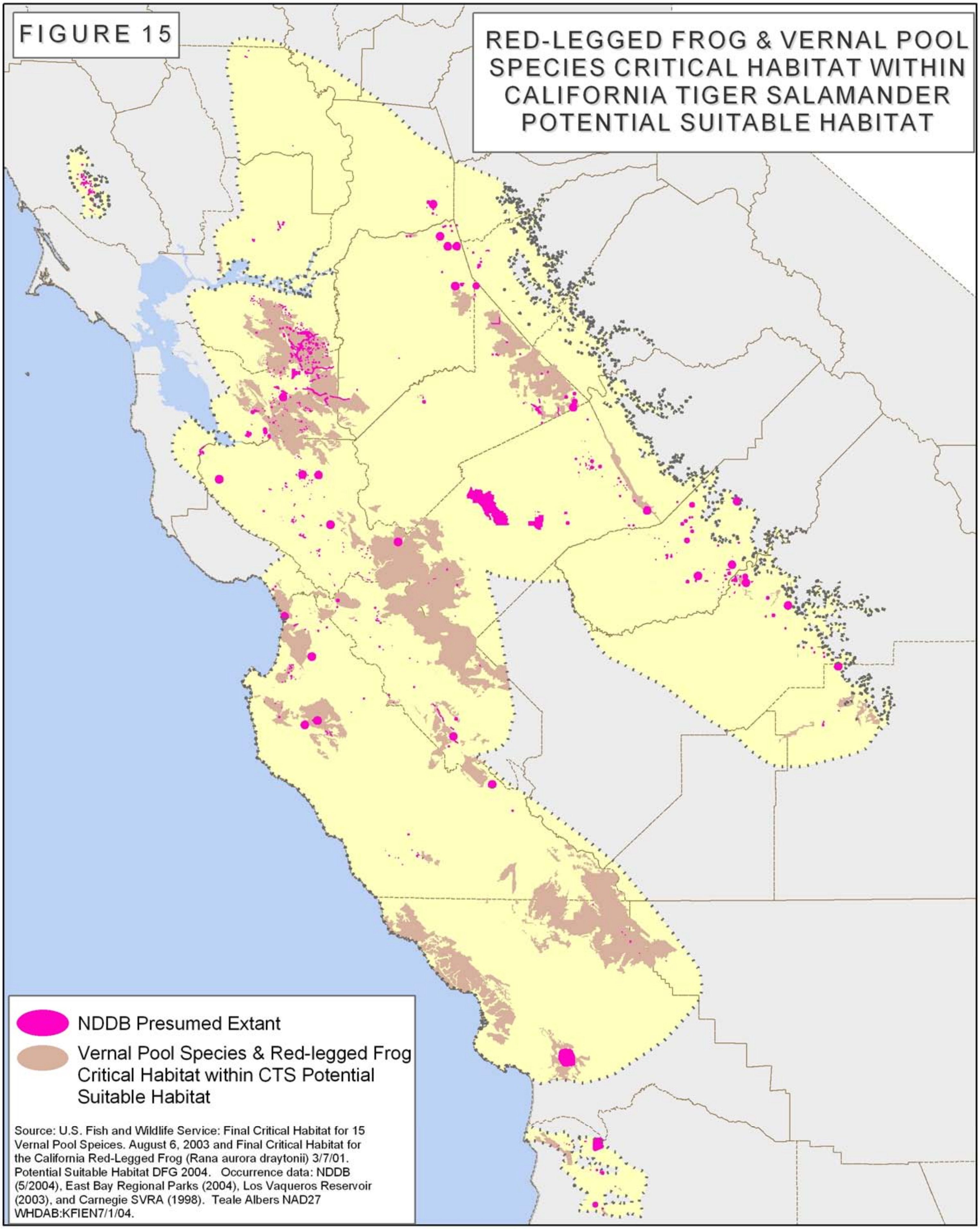


FIGURE 15
RED-LEGGED FROG & VERNAL POOL SPECIES CRITICAL HABITAT WITHIN CALIFORNIA TIGER SALAMANDER POTENTIAL SUITABLE HABITAT
NDDB Presumed Extant
Vernal Pool Species & Red-legged Frog Critical Habitat within CTS Potential Suitable Habitat
Source: U.S. Fish and Wildlife Service: Final Critical Habitat for 15 Vernal Pool Speices. August 6, 2003 and Final Critical Habitat for the California Red-Legged Frog (Rana aurora draytonii) 3/7/01. Potential Suitable Habitat DFG 2004. Occurrence data: NDDB (5/2004), East Bay Regional Parks (2004), Los Vaqueros Reservoir (2003), and Carnegie SVRA (1998). Teale Albers NAD27 WHDAB:KFIEN7/1/04.

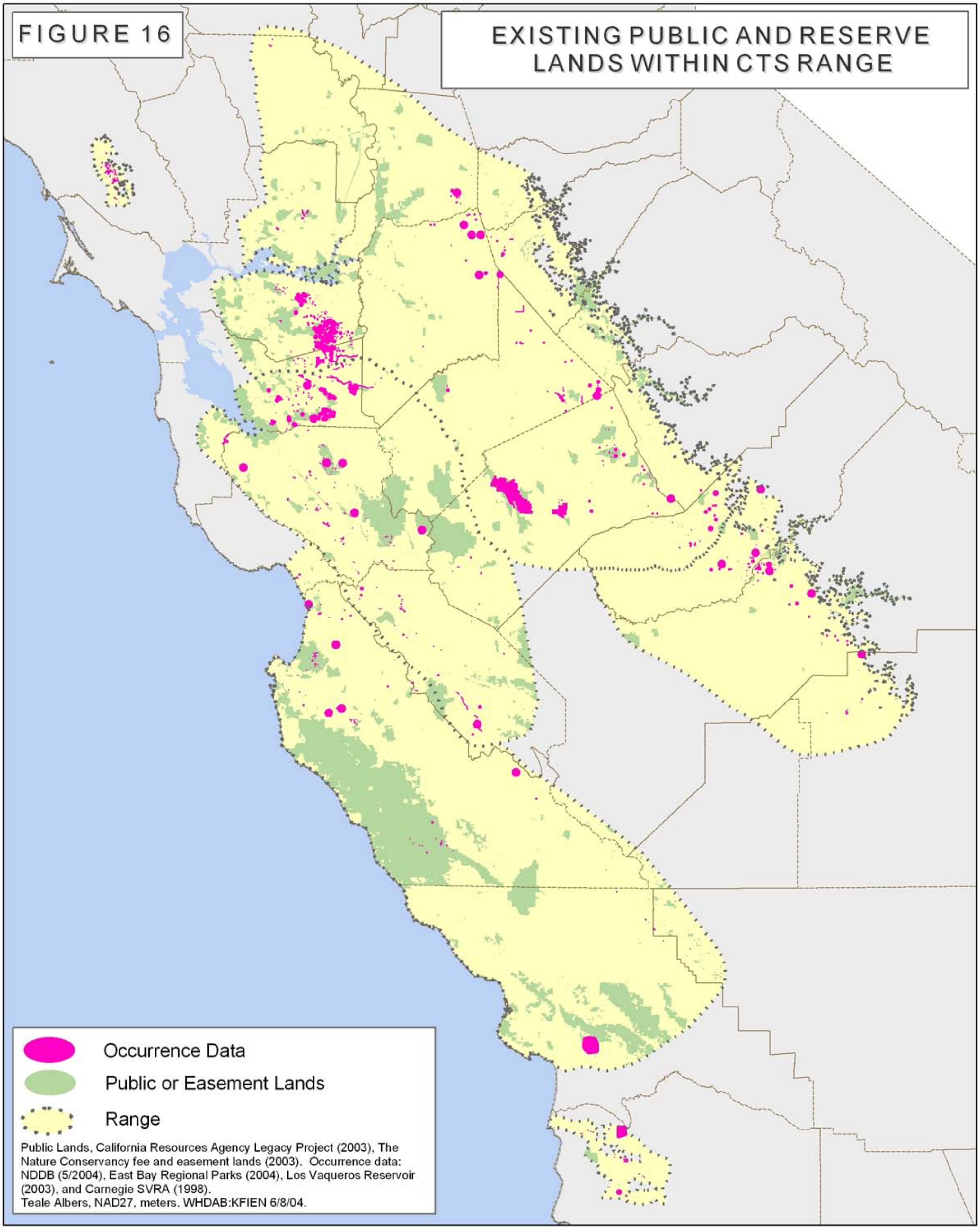


FIGURE 16
EXISTING PUBLIC AND RESERVE LANDS WITHIN CTS RANGE
Occurrence Data
Public or Easement Lands
Range
Public Lands, California Resources Agency Legacy Project (2003), The Nature Conservancy fee and easement lands (2003). Occurrence data: NDDB (5/2004), East Bay Regional Parks (2004), Los Vaqueros Reservoir (2003), and Carnegie SVRA (1998).
Teale Albers, NAD27, meters. WHDAB:KFIEN 6/8/04.

APPENDIX 1. GIS ANALYSIS AND CNDDB DATA NOTES

OCCURRENCE DATA

NDDB 1 May 2004. 707 Extant Records, 8 possibly extirpated and 39 extirpated (754 total).
East Bay Regional Parks: 26 May 2004. Data includes 71 CTS records. Ponds were surveyed in 96, 00 and 02. Data submitted to CNDDB.
Los Vaqueros Reservoir: 2004. USFWS provided data set with 65 records. Data submitted to CNDDB.
Carnegie SVRA: 1998. USFWS provided data set with 14 records. Data submitted to CNDDB.

CNDDB DATA NOTES (D. McGriff, CNDDB is Lead Zoologist, California Natural Diversity Database. California Department of Fish and Game. 2004. California Natural Diversity Database. 1 May 2004).

Response to Uram et al. (2003) Interpretation of Element Occurrence, Localities and Population Estimates

According to Appendix 6 GIS Methods, Uram et al. (2003) submitted to DFG, they used the CNDDB point layer rather than a polygon layer in their analyses. This is not an appropriate use of the CNDDB point layer as explained in the documentation provided with CNDDB RareFind program and also available at http://www.dfg.ca.gov/whdab/pdfs/CNDDBPNT_NotForAnalysis.pdf. Uram et al. (2003) made several invalid assumptions in their analysis - these assumptions have led to incorrect results of CTS locations and abundance analysis.

The CTS records in the CNDDB represent any documented collection, observation or museum specimen. These records may be of adults, eggs or larvae. The adults may be found in upland habitat, in or near a breeding area, during migration to or from a breeding area, or dead-on-road (DOR). Each of these observations/collections may be mapped separately, or, if there are multiple observations/collections within ¼ mile they are combined into a single Element Occurrence (EO).

Known Localities
While there are 754 EOs in the CNDDB (May 2003 RareFind), this does not translate into what Uram et al. (2003) refer to as “known localities”. Uram et al. (2003) have assumed that there are 754 distinct locations where populations of CTS are found. This assumption is invalid and incorrect. The CNDDB EOs are the site of documented observations or collections.

When CNDDB polygon EOs are buffered by 1.5 miles (Uram et al. [2003] buffered the points by 1.5 miles), these buffered areas are more properly called “known localities”. There are currently 91 buffered polygons statewide, with EOs that are “presumed extant”; 86 in the central area, one in Sonoma County and four in Santa Barbara County.

The number of “presumed extant” EOs is an overestimate. The CNDDB leaves an EO as “presumed extant” until we have some documentation that it is gone. Many of our EOs are in areas that are rapidly developing, they haven’t been rechecked in a number of years and are most likely now extirpated, so the number of “known localities” in probably less then reported above.

Uram et al. (2003) reports that “The actual number of CTS localities is higher than the known localities”, inferring that there are completely new and currently unknown locations where CTS are found. New EOs are most often new observations/collections within the vicinity of existing localities. Uram et al. (2003) may have recognized this if they had reviewed the GIS data by date.

Uram et al. (2003) reports that “The best available information is that each CTS locality has an average of over 1,000 individuals.” (no source provided). They also report, “Based on the number of known localities, we conservatively estimate the population at well over half a million individuals.” It appears that Uram et al. (2003) has simply multiplied each EO, (which again is a collection, observation, pond, or DOR individual), by 1000 to come up with 754 x 1000 = 754,000. As mentioned above EOs do not represent individual localities, this analysis represents an inaccurate use of the data. Uram et al. (2003) does not provide a source for their average population size of 1,000 individuals. Research published in 2001 reported CTS populations over a three years varied from three individuals to 327 with a mean of 63.5 CTS per pond (n=10) (Trenham et al. 2001)

Trenham, Pete, Walter Koenig & Brad Shaffer. 2001. Spatially autocorrelated demography and interpond dispersal in the salamander *Ambystoma californiense*. Ecology 82(12): 3519-3530.

<u>Occurrences Reported As Missing From CNDDB</u>
Uram et al. (2003) lists 74 CTS records in Appendix 40 that they claim are not found in the CNDDB. These records were checked against the CNDDB and 49 of these records are indeed in the CNDDB. Of the 25 records not in the CNDDB, 16 records came from LSA Associates but have not been submitted to the CNDDB, and 9 other records came from various sources.

Again the use of the GIS point layer was inappropriately used and could have contributed to the conclusion that some of these records were not in the CNDDB.

The following table compares the Uram et al. (2003) records to the CNDDB records:

LSA occurrence	CNDDB EO	Comments
732	27	In CNDDB prior to May 2003
733, 748, 756 & 757,	30	In CNDDB prior to May 2003
736, 738, 739, 744, 745	106	In CNDDB prior to May 2003
737	102	In CNDDB prior to May 2003
740	34	In CNDDB prior to May 2003
746	207	In CNDDB prior to May 2003
747	New	Main info is Joe Di Donato EBRPD
749	27	In CNDDB prior to May 2003
751	188	In CNDDB prior to May 2003
752-754	282-288	In CNDDB prior to May 2003 LSA location vague, we have 7 EOs in this area
755	272-3 & 275	In CNDDB prior to May 2003 LSA location vague, we have 3 EOs in this ¼ sec
758	New	Main info is EBRPD report
759	624	In CNDDB prior to May 2003
762	127	In CNDDB prior to May 2003
763	49	In CNDDB prior to May 2003
764	49	In CNDDB prior to May 2003
765	New	Main info is LSA
766	New	Main info is LSA
767	New	Main info is Dale DeNardo
768	473 & 474	In CNDDB prior to May 2003 LSA location is vague – only T&R, we have 2 EOs in that T&R
769	102	In CNDDB prior to May 2003
770	260	In CNDDB prior to May 2003 LSA gives this site as being in San Luis Obispo County, it’s actually in San Benito County.

771	537	In CNDDB prior to May 2003
772	572	In CNDDB prior to May 2003
773	600	In CNDDB prior to May 2003
774, 775 & 776		In CNDDB prior to May 2003 LSA location gives only quad name & Calero Res. We have 7 EOs in this area
777	600	In CNDDB prior to May 2003 This appears to be the same as LSA record 773, but they have it listed on an incorrect quad
778	540	In CNDDB prior to May 2003
779		Not in CNDDB until Jan 2004 LSA location given only as quad name & Grant Ranch reservoir. We have 18 EOs in Grant Co. Park
780, 781 & 782		In CNDDB prior to May 2003 LSA location given only as Sargent Ranch with vague directions. We have 4 EOs around the area described
783	318	In CNDDB prior to May 2003
784-789	New (6)	LSA location given only as Muzzy Ranch LSA is the main info source
790	New	LSA location given only as Gridley Mitigation Bank Main info is Trenham
791 & 792	485	In CNDDB prior to May 2003
793	New	LSA is the main info source
794	New	Serpa is the main info source
795	New	Serpa is the main info source
796-801	102?	Location given as ponds 1-10 & 12 in Carnegie SVRA. Unknown if these ponds fall within the boundary of occurrence 102
802 & 803	New (2)	Location given only as Fitzgerald Ranch Mitigation Bank. LSA is the main info source
804	781?	In CNDDB Jan 2004, our info was not from LSA Location given only as Veteran's park. This may be the same as occurrence 781. LSA is main info source
805	782	In CNDDB Jan 2004, our info was not from LSA. LSA is the main info source
806	New	Location given only as Vieira-Sandy Mush Mitigation Bank. USFWS is main info source
807	New	Location given only as San Louis (sic) Reservoir SRA. TNC is given as main info source
808	New	Location given only as Windemere Mitigation Area. LSA is main info source
809	New	Location given only as Chaparral Springs. LSA is main info source
810	New	LSA is main info source
811	New	Location given only as Eagle Ridge Mitigation Area LSA is main info source
812	New	Location given only as Laguna Creek Mitigation Bank. Main info source not given
813	New	Main info source is USDOE

<u>Removal of Records for Historic Range Determination</u>
The table below contains 23 occurrences from the CNDDB; three are presumed extant and 19 are extirpated that Uram et al. (2003) removed from consideration during creation of their version of CTS historical range.

For eight of these records the reason stated for their removal was “possible collection error, possible catalog error or possible introduction”. For the other 15 records stated their removal was based on “no specific locality information.” Nineteen of these 23 records are documented from museum specimens or scientific collections from reputable sources including: California Academy of Sciences, California State University Chico, Cornell University, Museum of Vertebrate Zoology at University of California Berkeley, Stanford University, the Smithsonian, and University of California, Davis.

General locations are mapped 1 mile or 5 mile radius circles to show that they are very general. Again the correct use of polygon data rather than point data would have provided more insight as to the general nature of some of the mapped locations.

The only record that they can legitimately question is the San Jacinto record in Riverside County from 1892. However, considering the disjunct distribution of *Rana muscosa* also known from San Jacinto CTS could have existed there.

CNDDB occurrence	**Location**	**Year**	**Comments**
61	Grass Lake		Removed from CNDDB as erroneous
85	Greylodge, Butte County	1965	LSA says “possible introduction”. CNDDB documents records from the 1950’s as well as 1965. (extirpated)
587	Drainage ditch along Hwy 99 about 1.5 mi north of Willows	1963	LSA says “possible collection, or catalog error or introduction”. CNDDB source: specimen in CSU Chico museum. (extirpated)
529	Alameda	1886	LSA says “possible collector or catalog error”. CNDDB source: CAS specimens. It is a 1 mi radius circle. (extirpated)
384	Southwest corner of Covell Blvd & Lake Blvd. Davis	1993	LSA says “possible escaped captive”. This site is across the street from “wet pond” a city owned wildlife habitat area.
414	Coarsegold, Madera County	1951	LSA says “possible collection or catalog error, likely from Coarsegold creek further to the west.” CNDDB source: MVZ specimens. It is a 1 mile radius circle that includes Coarsegold Creek & surrounding ponds. Data were reviewed and accepted by John Brode in 1986.
530	Danville, vicinity of San Ramon Creek	1952	LSA says “Possible collection or catalog error”. CNDDB source: CAS specimens. (extirpated)
2 (LSA calls this 12)	San Jacinto	1892	LSA says “Possible collection or catalog error”. CNDDB source: Stanford University collection. Record is disjunct. (extirpated)
59	2 miles east of Dixon	1953	LSA says “Possible collection or catalog error”. CNDDB source: UC Davis specimen record (extirpated)
43	Concord	1921	LSA says “No specific locality info”. CNDDB source: MVZ specimens from 1919 & 1921. It is a 1 mi radius circle to show generalness. (possibly extirpated)
413	Pacheco	1920	LSA says “No specific locality info”. CNDDB source: MVZ specimen data. It is a 1 mi radius circle to show generalness. (extirpated)
535	Antioch	1983	LSA says “No specific locality info. CNDDB source: CAS specimen data. It is a 1 mi radius circle to show generalness. (extirpated)
582	Walnut Creek	1938	LSA says “no specific locality info, possible introduction.”

			Our info from USNM specimen data. (extirpated)
583	Fresno	1936	LSA says "no specific locality info." CNDDB source: 1879 USNM specimen and 1936 Cornell specimen. It's a 5 mi radius circle to show extreme generalness.(extirpated)
612	Kings River below Kingsburg	<1925	LSA says "no specific locality info." CNDDB maps a 1 mi radius circle to show generalness (extirpated)
536	Salinas	1952	LSA says "no specific locality info." CNDDB source: CAS specimen data. It's a 1 mi radius circle to show generalness.
415	Galt	1914	LSA says "no specific locality info." CNDDB source: MVZ specimen data. 1 mile radius circle to show generalness (extirpated).
17	Escalon	1920	LSA says "no specific locality info." CNDDB source: CAS specimen data. 1 mile radius circle to show generalness. (extirpated)
33	Ripon	1912	LSA says "no specific locality info." CNDDB source: MVZ specimen data. 1 mi radius circle to show generalness. (extirpated)
416	Palo Alto	1893	LSA says "no specific locality info." CNDDB source: multiple Stanford University specimens from 1892 & 1893. It's a 1 mi radius circle to show generalness. (extirpated)
41	San Jose	1895	LSA says "no specific locality info." CNDDB source: Stanford University specimen data. It is a 5 mile radius circle to show extreme generalness. (extirpated)
42	Madrone	1981	LSA says "no specific locality info." CNDDB source: 1931 MVZ record & 1981 CAS record. 1 mile radius circle to show generalness. (extirpated)
44	Oakdale	1975	LSA says "no specific locality info." CNDDB source: 1927 MVZ record & a 1975 observation. 1 mile radius circle to show generalness. (extirpated)

CAS – California Academy of Science, MVZ – Museum of Vertebrate Zoology, USNM – the Smithsonian, CSU Chico – California State University Chico, UC Davis – University of California Davis.

RANGE

DFG CTS Range (2004):

Sonoma and Santa Barbara ranges were defined by USFWS for these federally listed populations. Bay Area, Central Coast, Central Valley and Southern San Joaquin Valley were based on Shaffer and Trenham (2002) and modeled using a variety of sources.

Eastern edge of range was defined by 1,500 foot elevation except around NDDB occurrence #414 near Coarsegold. This occurrence, originally dated in 1951 (MVZ 54067-54072), was reviewed and accepted by John Brode in 1986. Based on the 1986 review by John Brode the range was expanded to include this potential population.

The Central and Southern San Joaquin Valley Region separation was defined by the Fresno River. Vernal pool density and San Joaquin Valley vernal wetlands databases, as well as precipitation data were used to help define the southern boundary. Areas along the western edge of the Southern San Joaquin Valley were expanded to include documented vernal wetland areas.

Jepson Ecological boundaries were used as guides in the Great Valley and Central Western Regions. Areas in Yolo, Solano, Monterey, and San Luis Obispo were expanded to align with these ecological boundaries
The Central and Bay Area populations Regions used Hwy 580 as a guide and approximately 300 foot elevation to separate the two areas.

Changes made that deviated from the DPS areas initially defined by Shafter and Trenham were reviewed by P. Trenham 2004.

POPULATION BOUNDARY DATA

All 707 **extant (5/1/04)** occurrences are included within these boundaries:

NDDB Occurrences by Population Region

Population Region	**NDDB extant**	**% extant occurrences**	**NDDB Extirpated**	**% extirpated occurrences**
Bay Area	225	32%	11	30%
Central Coast	84	12%	0	
Central Valley District	278	39%	15	41%
Santa Barbara	20	3%	0	
Sonoma	51	7%	1	3%
Southern San Joaquin	50	7%	10	27%

One record crosses Bay Area and Central Valley District

Elevation Range of NDDB Occurrences within Population Boundaries (Polygon layer)

Population Region	**MIN**	**MAX**	**RANGE**
Bay Area DPS	8	4340	4332
Central Coast DPS	0	2731	2731
Central Valley District DPS	6	2065	2059
Santa Barbara DPS	186	1048	862
Sonoma DPS	89	302	213
Southern San Joaquin DPS	263	1500	1237

Shaffer, B. and P. Trenham. 2002. Distinct population segments of the California tiger salamander, *Ambystoma californiense* Section of Evolution and Ecology, and Center for Population Biology University of California, Davis, CA 95616 Figure 3.

California Department of Fish and Game. 2004. California Natural Diversity Database. 1 May 2004.

U. S. Fish and Wildlife Service and California Department of Fish and Game. 2003. Range for Santa Barbara and Sonoma California tiger salamander populations.

California Department of Fish and Game. 1997. Central Valley Wetlands and Riparian.

U. S. Fish and Wildlife Service and Dr. R. Holland. 1996. Central Valley Vernal Pools Complexes. Sacramento, California.

DFG/FWS Boundary file – modified WHR range. Created in October 2003 DFG & USFWS Jim Browning FWS and B. Bolster.

California Department of Fish and Game. GIS Library: Jepson Ecological Boundaries, Precipitation data, and 30 m DEM.

HYBRID DATA

Received from USFWS with Shaffer's approval. Reprojected data into Teale NAD27.
Exotics – *A. tigrinum* sites
Hybrid – 2003 sites

Received digital data of negative detections from 1993 report from P. Trenham 6/8/04
304 records created shapefile and projected into Teale NAD27

A. tigrinum located in Central Coast Region
Hybrids located in Central Coast, Bay Area and Central Valley Districts.
Sonoma, Southern San Joaquin and Santa Barbara no hybrids reported in this dataset.

Population Region	*A. tigrinum*	Hybrid
Central Valley District DPS	Yes	Yes
Santa Barbara DPS		Not reported
Southern San Joaquin DPS		Not reported
Central Coast DPS		Yes
Bay Area DPS		Yes
Sonoma DPS		Not reported

Shaffer, H. B., R. N. Fisher, and S.E. Stanley. 1993. Status Report: The California tiger salamander *(Ambystoma californiense)*, California Department of Fish and Game. Absence data.
Shafer, B. 1990 - 2002. GIS data set of California Tiger Salamander hybrid and non-native sites. The University of California. Davis, CA.

VEGETATION and HABITAT

DFG used the California Gap Analysis Project (GAP) (1998), U. S. Department Agriculture Forest Service California Vegetation (CalVeg2) (1999) and Central Valley Wetlands and Riparian (CVWR) (1997). Uram et al. (2003) used the Multi-source Land Cover Data (2002 version2), below, in their GIS analysis.

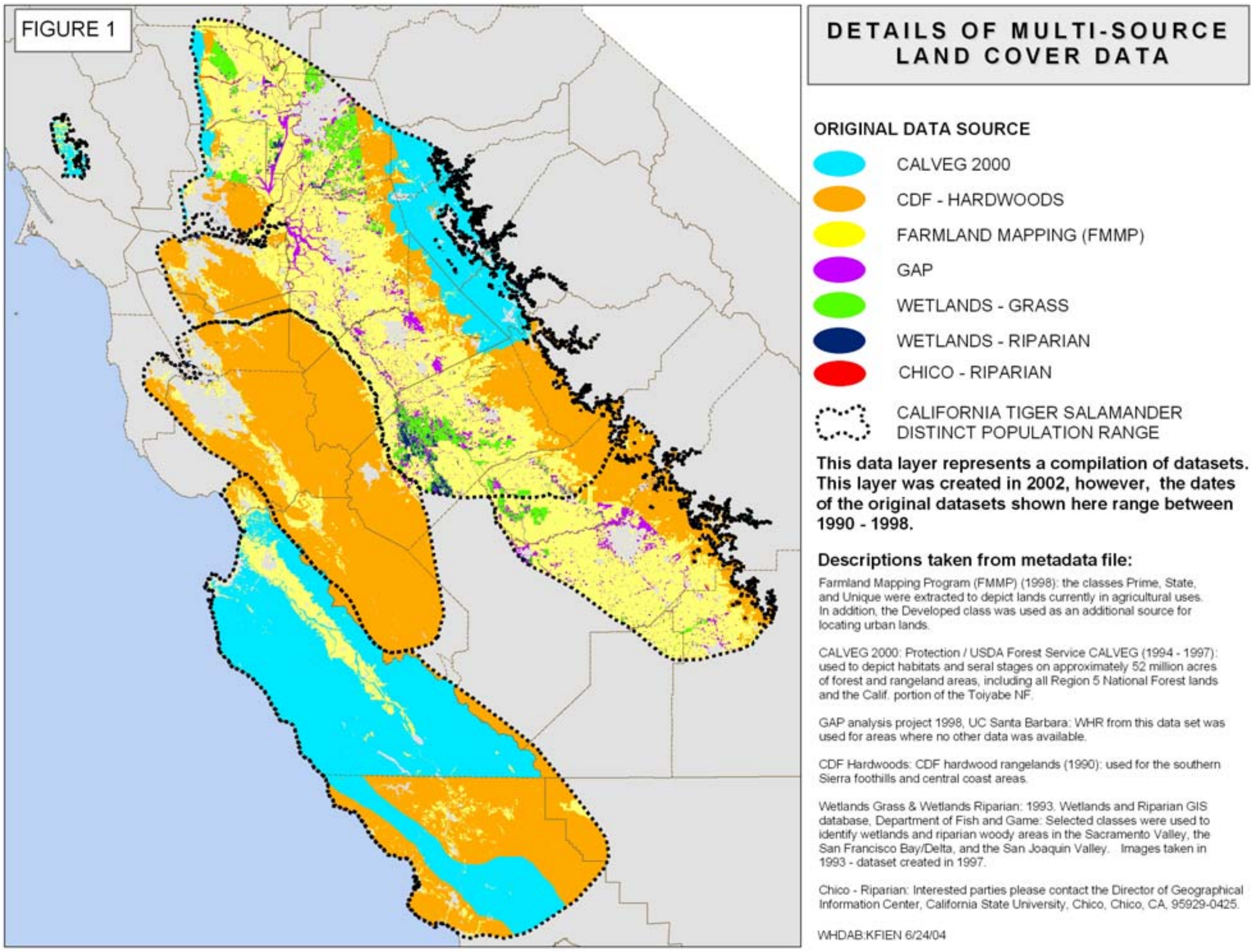
The Multi-source Land Cover dataset was not used by the Department of Fish and Game (DFG). It consists of a compilation of various vegetation and farmland mapping datasets. While the data were compiled in 2002, the data sources used within the CTS range are dated between1990 – 1998. The figure below shows the geographic area covered by each data source. Portions of all three of the datasets DFG used for analysis were incorporated into this file.

Calveg2 represents a very detailed mapping effort; however, much of the CTS range has not been completed. Calveg2 was used to define the Sonoma range because the entire area has been mapped and provided more detail than the GAP data. This data layer was dated 1999, however, the area of interest was last updated in 1994.

GAP data were used for the remaining portions of the range and CVWR data were used to define more detail on the floor of the Central Valley and portions of the Delta.

The Multi-source Land Cover dataset used the Department of Conservation Farmland Mapping data to describe most of the Central Valley. This does not represent the most detailed data available.

California Department of Forestry and Fire Protection. 2004. Multi-source Land Cover Data (2002 v2).
University of California. 1998. California Gap Analysis Project (GAP). Santa Barbara, CA
California Department of Fish and Game. 1997. Central Valley Wetlands and Riparian.
U. S. Department of Agriculture Forest Service. 1999. California Vegetation (CalVeg2).



AGRICULTURE

DFG used Department of Water Resources Land Use Survey data were used to identify certain agriculture types within the CTS range. Orchard and vineyard categories (Class = D, C, V). Data ranged from 1994 -2003. The Central Valley Wetlands and Riparian dataset category orchard/vineyard was also used.

California Department of Water Resources. Various dates by County. California Department of Water Resources Land Use Survey Data. Kings (2003), San Benito (2002), Madera (2001), Fresno, Sacramento (2000), Tulare (1999), Mariposa, Sutter (1998), Amador, Monterey, Santa Cruz, Yolo (1997), Legal Delta, San Joaquin, Stanislaus, South Central Coast (1996), Contra Costa, Merced (1995), and Solano (1994).
California Department of Fish and Game. 1997. Central Valley Wetlands and Riparian.

Grazing

Uram et al. (2003) used the Department of Conservation Farmland Mapping Data (FMMP) to examine changes in grasslands. These comments refer to a letter sent to Sandy Morey from Robert Uram dated June 8, 2004.

Comments on Table1. page 7.
Data for 10 counties was examined between 2000 and 2002. FMMP data were clipped to the CTS range (Uram et al. (2003) version of CTS range) and changes were calculated by Uram et al. (2003).

DFG examined the same 10 counties between 2000 and 2002; however, DFG examined the data county wide for two reasons. First, at the county scale these data can be compared to the analysis and reports produced by the data source, the Department of Conservation FMMP. These reports contain more documentation on the mapping process and changes in classification than the GIS layers. Secondly, DFG used a different range than Uram et al. (2003). Using the county wide data allows analysis to be compared over time with existing not changing government defined boundaries.

Reports downloaded from California Department of Conservation Division of Land Resources Protection Farmland Mapping Program can be viewed at: http://www.consrv.ca/gov/dlrp/fmmps/stats_reports/county_counversion_tables.html. From these reports the following information was extracted and presented in table 1: (total acreage inventoried 2000 and 2002, acres lost (grazing), acres gained (grazing), conversion from urban and built-up land primarily the result of the use of digital imagery to delineate more distinct urban boundaries (to grazing), and between other land and grazing land primarily the result of the use of digital imagery to delineate more distinct rural residential boundaries). When the acreages of conversion to grazing that are explained by mapping process and do not reflect actual changes in land use are removed, the net change in grasslands between 2000 and 2002 shows an 11,289 acre decline in grasslands within these 10 counties. By simply using the resulting GIS layers between 2000 and 2002 makes it difficult to identify the changes between farmland mapping categories that do not reflect actual land use changes over the landscape.

Table 1.

FARMLAND MAPPING PROGRAM GRAZING CHANGES FROM 2000 - 2002

Response to Table 1. Sheppard Mullin letter to Sandra Morey dated June 8, 2004

COUNTY	TOTAL ACRES 2000	TOTAL ACRES 2002	ACRES LOST	ACRES GAINED	ACRES GAINED EXPLAINED BY MAPPING PROCESS*	REMAINING GAINED ACRES	NET CHANGE WHEN MAPPING PROCESS CONSIDERED
ALAMEDA	247,218	245,728	3,431	1,941	1,044	897	-2,534
AMADOR	190,793	191,039	912	1,158	191	967	55
CONTRA COSTA	172,053	172,368	2,731	3,046	2,338	708	-2,023
KINGS	238,485	236,583	2,638	736	99	637	-2,001
MARIPOSA	408,323	406,424	4,493	2,594	2,516	78	-4,415
SAN BENITO	595,537	598,855	3,116	6,434	205	6,229	3,113
SANTA CLARA	389,210	388,696	3,006	2,492	1,480	1,012	-1,994
SANTA CRUZ	16,587	16,691	304	408	64	344	40
SAN MATEO	45,716	45,829	188	301	38	263	75
SOLANO	201,813	201,338	4,814	4,339	1,130	3,209	-1,605
TOTALS			**25,633**	**23,449**	**9,105**	**14,344**	**-11,289**

*Conversion from Urban and Built-up Land primarily the result of the use of digital imagery to delineate more distinct urban boundaries, and between other land and grazing land primarily the result of the use of digital imagery to delineate more distinct rural residential boundaries. Note taken directly off Ca Dept. of Conservation statistics tables: http://www.consrv.ca/gov/dlrp/fmmps/stats_reports/county_counversion_tables.html (see statistics file by county).

Table 2. page 8.
Table 2 in Uram's letter appears to describe changes in classification from "Grazing" to other Farmland Mapping categories, rather than discussing total acreage of grazing land changes between 1990 and 2000. The following table describes total acreage of grazing habitat mapped between 1990 and 2000. These data presented in the table have not been adjusted for changed due to digital imagery.

Uram's letter states that "the Petition reports only on the losses of grazing lands, and does not consider the conversion of land to grazing uses". The table below reports acreage of grazing lands mapped in 1990 and 2000, it includes changes to grazing and changes from grazing.

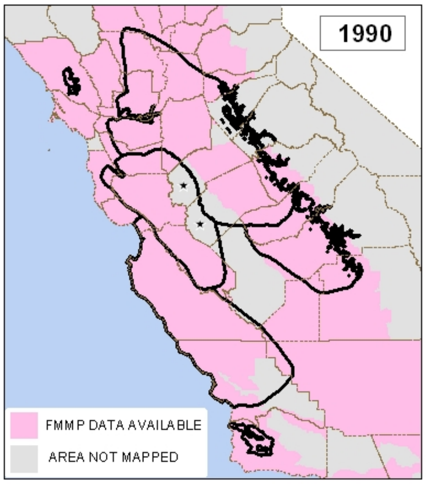
FARMLAND MAPPING PROGRAM GRAZING CHANGES
1990 – 2000 (County Wide)

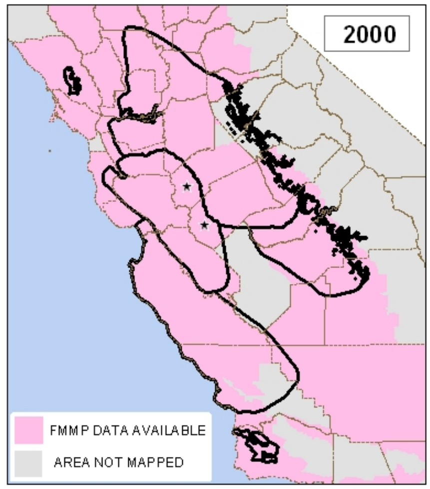
Response to Table 1. Sheppard Mullin letter to Sandra Morey dated June 8, 2004

COUNTY	TOTAL ACRES 1990	TOTAL ACRES 2000	NET CHANGE
Alameda	254,324	247,226	-7,099
Amador	191,536	190,793	-743
Contra Costa	179,022	171,254	-7,768
Fresno	314,704	319,691	4,987
Kern	1,725,018	1,775,521	50,503
Kings	223,749	238,301	14,552
Madera	403,851	401,568	-2,283
Mariposa	407,984	408,308	324
Merced	212,313	217,724	5,411
Monterey	1,080,000	1,060,633	-19,367
Sacramento	174,467	162,342	-12,125
San Benito	586,869	595,537	8,668
San Joaquin	157,880	150,332	-7,548
San Luis Obispo	665,468	662,020	-3,448
San Mateo	46,056	45,716	-339
Santa Barbara	596,377	583,709	-12,668
Santa Clara	405,720	389,210	-16,510
Santa Cruz	16,828	16,587	-241
Solano	205,640	198,825	-6,814
Sonoma	445,089	432,686	-12,403
Stanislaus	117,919	114,184	-3,735
Tulare	457,465	439,934	-17,531
Yolo	135,689	144,696	9,007
TOTALS	**9,003,968**	**8,966,797**	**-37,171**

*Western portions of Merced and Stanislaus counties were not mapped in 1990, these areas were removed from the 2000 calculations to accurately compare changes. Department of Conservation Farmland Mapping Program 1990 and 2000 by County.

Grazing Conversion Calculated by CTS Range





ACREAGE OF FMMP GRAZING LANDS WITHIN CTS RANGE			
COUNTY	**1990**	**2000**	**Change**
Alameda	254,240	247,133	-7,107
Amador	112,700	112,779	79
Colusa	129	0	-129
Contra Costa	169,810	162,023	-7,787
El Dorado	345	345	0
Fresno	181,239	181,631	391
Kern	123,881	126,381	2,500
Kings	24,982	25,155	173
Madera	299,828	302,023	2,195
Merced	212,308	217,724	5,415
Monterey	1,066,827	1,047,472	-19,355
Mariposa	221,998	222,990	993
Sacramento	149,496	139,609	-9,887
Santa Barbara	145,532	135,078	-10,454
San Benito	532,988	541,517	8,529
Santa Clara	405,711	389,201	-16,510
Santa Cruz	7,328	6,856	-472
San Joaquin	157,877	150,329	-7,548
San Luis Obispo	574,399	572,081	-2,318
San Mateo	3,281	3,066	-215
Solano	150,259	146,739	-3,520
Sonoma	5,919	5,030	-889
Stanislaus	117,917	114,184	-3,732
Sutter	1,311	1,802	491
Tulare	60,668	52,023	-8,645
Yolo	37,996	45,985	7,989
TOTALS	**5,020,959**	**4,951,157**	**-69,812**

★ Western portions of Merced and Stanislaus counties were not mapped in 1990, these areas were removed from the 2000 calculations to accurately compare changes. Department of Conservation Farmland Mapping Program 1990 and 2000 by County.

GROWTH AND DEVELOPMENT

Growth – Created gis layer from Department of Finance report:
State of California, Department of Finance, *Interim County Population Projections.* Sacramento, California, June 2001.
Data shows estimated population and percent increase.

Urban – US Bureau of the Census 2000
U.S. Department of Commerce, Bureau of the Census Geography Division
Urban Area (UA) and Urban Clusters (UC) were used to define urban sites.

URBANIZED AREA (UA):
For Census 2000, the Census Bureau classifies as "urban" all territory, population, and housing units located within an urbanized area (UA) or an urban cluster (UC). It delineates UA and UC boundaries to encompass densely settled territory, which consists of:

- core census block groups or blocks that have a population density of at least 1,000 people per square mile and
- surrounding census blocks that have an overall density of at least 500 people per square mile

In addition, under certain conditions, less densely settled territory may be part of each UA or UC. A UA comprises one or more places ("central place") and the adjacent densely settled surrounding territory ("urban fringe") that together have a minimum of 50,000 persons. The urban fringe generally consists of contiguous territory having a density of at least 1,000 persons per square mile. The urban fringe also includes outlying territory of such density if it was connected to the core of the contiguous area by road and is within 1 ½ road miles of that core, or within 5 road miles of the core but separated by water or other undevelopable territory. Other territory with a population density of fewer than 1,000 people per square mile is included in the urban fringe if it eliminates an enclave or closes an indentation in the boundary of the urbanized area. The population density is determined by (1) outside of a place, one or more contiguous census blocks with a population density of at least 1,000 persons per square mile or (2) inclusion of a place containing census blocks that have at least 50 percent of the population of the place and a density of at least 1,000 persons per square mile.

General Plan **–**
Categories considered (industrial, high, medium and low residential and commercial.
Metadata definitions from General Plan White Doc. Low Density Residential and Very Low Density Residential:

In most county zoning, agricultural, low density residential (LDR) and very low density residential (VLDR) are different land use categories. However, county general plan diagrams gave little indication of the spatial distribution of these categories and mapped all larger parcel rural uses into the agricultural category. In most county general plans, these two residential land uses are included in the agriculture category. As a result, we had to infer the areas zoned for, or permitting, LDR and VLDR from census and other data. LDR and VLDR development is very important for habitat planning purposes and estimating the location of these uses is critical to understanding land use and conservation scenarios. We define LDR as parcels with permitted size minimums from 2 to 20 acres and **VLDR as parcels with 20 to160 acre minimums**. Areas with parcels over 160 acres we defined as agriculture.

We inferred the LDR and VLDR areas by using census block population data, which we purchased from Geolytics, Inc. These data contain the 1990 and 2000 population data, with both years in the 2000 block boundaries. Because these two data sets are in the same boundaries, we get change in population between 1990 and 2000 for all blocks in California. We can convert the population density in 2000 to dwelling density, and we can also calculate absolute change and rate of change in dwellings. The LDR and VLDR areas are derived from acres per dwelling unit (acres/du) in 2000. We supplemented this analysis with data on the growth rate from 1990 to 2000, in cases where there was a borderline dwelling density in 2000 and we couldn't decide whether to classify an area as LDR or VLDR or agriculture. If the growth rate was high, we classified the area into the higher of the two categories at issue. We give the detailed steps used in ArcView, below.

The general plan data that I used is dated April 2004, it contains data for all 58 counties. I compared the data with a city limit layer and did not identify any areas that were left out.

HABITAT LOSS BY POPULATION

Estimated Loss By Region	Total Acres Population	Urban	General Plan not included in Urban estimate	Orchard Vineyard	Loss to Range	% region identified as urban, developed under the general plan or orchard vineyard agriculture
Bay Area	2,656,132	293,326	256,794	42,230	592,350	22.3%
Central Coast	3,969,390	128,803	169,876	80,156	378,834	9.5%
Central Valley District	5,693,728	595,554	727,093	634,943	1,957,590	34.4%
Santa Barbara	186,862	5,158	7,005	7,827	19,989	10.7%
Sonoma	58,336	25,416	9,380	4,549	39,345	67.4%
Southern San Joaquin	1,737,385	147,894	380,533	490,822	1,019,249	58.7%

Remaining Habitat Suitability	**Remaining Range**	**Suitable Habitat**	**Unsuitable Habitat**
Bay Area	2,073,927	1,231,423	842,504
Central Coast	3,591,067	1,803,645	1,787,422
Central Valley District	3,662,387	1,591,004	2,071,383
Santa Barbara	166,872	99,617	67,256
Sonoma	19,648	7,338	12,310
Southern San Joaquin	722,443	318,736	403,707

Population Region	**Acreage Population**	**Suitable Habitat**	**Percent Region with Suitable Habitat**
Bay Area	2,656,132	1,231,423	46%
Central Coast	3,969,390	1,803,645	45%
Central Valley District	5,693,728	1,591,004	28%
Santa Barbara	186,862	99,617	53%

Sonoma	58,336	7,338	13%
Southern San Joaquin	1,737,385	318,736	18%
Total Area	14,301,832	5,051,763	35%

Habitat Loss by populations calculated acreages of:
Urban: US Bureau of the Census 2000.
General Plan: State of California Legacy Project, low, medium and high density commercial and residential, and industrial.
Department of Water Resources Land Use Survey and Central Valley Wetlands and Riparian Data: orchard and vineyards.

Habitat Remaining Calculated using GAP Vegetation data for all populations except Sonoma which used Calveg2
Suitable Habitat within each population:
Bay Area: annual grassland, blue oak woodland, coastal oak woodland, lacustrine, valley oak woodland and valley foothill riparian
Central Coast: annual grassland, blue oak woodland, coastal oak woodland, lacustrine, valley oak woodland and valley foothill riparian
Central Valley: annual grassland, blue oak woodland, coastal oak woodland, freshwater emergent wetland, lacustrine, pasture, perennial grass, valley oak woodland, valley foothill riparian, wet meadow
Santa Barbara: annual grassland, coastal oak woodland, and valley oak woodland
Southern San Joaquin: annual grassland, blue oak woodland, freshwater emergent wetland, lacustrine, valley oak woodland and valley foot hill riparian
Sonoma: annual grassland/forbs, coast live oak, tule cattail sedge, and valley oak

CRITICAL HABITAT (USFWS)

Vernal Pool Species and Red-legged Frog Critical Habitat do not provide coverage for most of the CTS range.

Uram et al. (2003) claims that CTS are protected by being within CRLF core areas for recovery efforts. This is incorrect. According to the CRLF recovery plan, “Core areas include many watersheds within their boundaries. They were mapped by selecting the appropriate Hydrologic Sub-Areas per the California Watershed Map (CALWATER version 2.2)”, “…the entire area described as a core area may not represent suitable California red-legged frog habitat.”, and, “…many portions of the mapped core areas are agricultural lands, and urban developments which, in most cases, will be considered unsuitable and excluded from the recovery efforts.”

LAND OWNERSHIP

Public Lands and Easements – California Resources Agency Legacy Project (2003),
TNC - The Nature Conservancy fee and easement lands (2003).

Military Lands Removed. TNC layer separate but acreages combined into “Other category”
119 of 707 (17%) extant occurrences intersect with a public land.
74 polygons intersect with CNDDB, representing 60 properties
35% of public land within CTS range have documented CTS occurrence.

Public Lands with documented CTS occurrences		
Ownership	Acres	Percent
Federal	220,706	48%
State	121,123	26%
Local	59,773	13%

Other	61,204	13%
Total	462,806	

Total public acres within range 1,336,400

Ownership of these lands: Bureau of Land Management, Various Water Districts, City/County Parks, Dept Fish & Game, Dept Parks and Recreation, East Bay Regional Park District, Livermore area recreation, Solano County, State Lands Commission, TNC, UC, USFWS and USDA Forest Service.

Of these same locations, acres public land by region:

Region	Acres	Percent
Bay Area	208,521	45%
Central Coast	124,666	27%
Central Valley	128,713	28%
Sonoma	169	<1%
S. San Joaquin	737	<1%
Total	462,806	

No public land intersected with CTS in Santa Barbara Region

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